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Warminster, Pennsylvania 18974

V/STOL 'A'
AVIONICS FUNCTIONAL DESCRIPTION II

VOLUME IV
APPENDIX
FUNCTIONAL TREE BLOCK DIAGRAMS

Prepared by:
Center Design Team
7 July 1978

Avionics Functional Description II

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Chapter III - Notional System Concepts

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GLOSSARY OF ABBRIEVIATED TERMS

AA	Anti-Air
AAAS	Advanced Aircraft Armament System
AAES	Advanced Aircraft Electrical System
AAFIS	Advanced Avionics Fault Isolation System
AAM	Anti-Air Missile
AAS	Aircraft Armament System
AAW	Anti-Air Warfare
A/C	Aircraft
AC	V/STOL launched from CV
ACAN	Acoustic Analyst
A/D	Analog-to-Digital
AD	Advanced Development
AD	Auxiliary Display
ADAS	Air Dropped Array System
ADF	Automatic Direction Finding
ADM	Advanced Development Model
ADP	Automatic Data Processing
adv.	advanced
AE	Aviation Electrician
AES	Advanced Electrical System
AEW	Airborne Early Warning
AFD	Avionics Functional Description
AGR	Air-to-Ground Radar
AHE	Arming Handling Equipment
AHRS	Altitude Heading Reference System
AI	Air Intercept
AIDS	Advanced Integrated Display System
AIR	Acoustic Intercept Receiver
AIRAD	Air Intercept Radar
AIRSS	Airborne Intercept Radar Search Set
AIRST	Air Search Telescope
AIS	Acoustic Intercept System
ALOFT	Airborne Light Optical Fiber Technology
ALWT	Advanced Light Weight Torpedo
AMAC	Aircraft Monitoring and Control
AMH	Aviation Maintenance Hydraulics
amp.	amplitude
AMS	Aviation Maintenance Structure
AO	Aviation Ordinanceman
AOA	Area of Arrival
APU	Auxiliary Power Unit
AQ	Aviation Fire Control Technician
ARM	Anti-Radiation Missile
ARAPAHO	Merchant cargo ship modified to carry V/STOL aircraft, TASS, and weapons
ARPR	Automatic Radar Pattern Recognition
A-S	Air-to-Surface
ASAM	Active synthetic aperature radar anti-ship missile
ASM	Anti-Ship Missile
ASMD	Anti-Ship Missile Defense

ASPJ	Advanced Self Protection Jammer
ASST	Anti-Ship Surveillance and Targeting
ASUW	Anti-Surface Warfare
ASW	Anti-Submarine Warfare
AT	Avionics Technician
ATAC	Airborne Transportable Acoustic Communications
ATC	Air Traffic Controller
ATE	Automatic Test Equipment
ATF	Amphibious Task Force
ATLAS	Abbreviated Test Language for Avionics Systems
ATR	Standard Avionics Package
AU	Analyzer Unit (Proteus)
AV	V/STOL launched from VSS
AWG-9	Airborne Weapons Guidance Radar System-9
BLOS	Beyond Line-of-Sight
BARCAP	Combat Air Patrol aircraft employed in barrier between the U.S. task force and the threat force
BCM	Beyond Capability of Maintenance
BCU	Bus Control Unit
BIT	Built-in-Test
BITE	Built-in-Test Equipment
BPS	Bits per second
Brg.	Bearing
CAP	Combat Air Patrol
CASS	Command Active Sonobuoy System
CCDP	Crew Control and Display Panel
C^2	Command and Control
C^3	Communication, Command, and Control
CCD	Charge Coupled Device
CDT	Center Design Team
CFAR	Contact False Alarm Rate
CGN	Guided Missile Cruiser
CIC	Communications Intelligence Center
CIDS	Coordination in Direct Support
CM	Countermeasures
CMS-2M	Compiler Monitor System-2M
Comm	Communications
COMSAT	Communications Satellite
CNI	Communication, Navigation and Identification
COD	Carrier On-board Delivery
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CSDR	Combat System Design Requirements
CTOL	Conventional Take-Off and Landing
CV(A)	Aircraft Carrier (Attack)
CVIC	Carrier Intelligence Center
CVN	Aircraft Carrier (Nuclear)
CVS	Correlation Velocity Sensor
CVV	Medium Size Carrier
CW	Continuous Wave

DAIS	Digital Avionics Integrated System
dB	decibels
DECM	Defensive Electronic Countermeasures
DF	Direction Finding
DFBW	Digital Fly-by-Wire
DFCS	Digital Flight Control System
DICASS	Directional CASS
DIFAR	Directional Frequency Acoustic Ranging
D-Level	Depot Level
DLI	Deck Launched Interceptor
DLIR	Downward Looking Infrared
DMA	Data Management Acquisition
DME	Distance Measuring Equipment
DOA	Direction of Arrival
DOD	Department of Defense
DR	Dead Reckoning
DS	Direct nuclear support submarines assigned to conduct ASW operations in direct support of a U.S. task force
DSARC I	Defense System Acquisition Review Council (pre-ADM)
DSARC II	Defense System Acquisition Review Council (pre-FSD)
DT	Data Terminal
DT&E	Development Test and Evaluation
ECCM	Electronic Counter-Counter Measures
ECM	Electronic Countermeasures (Active)
ECOM	Electronic Command
ECP	Engineering Change Proposal
ECS	Environmental Control System
EDM	Engineering Development Model
ELOS	Extended Line-of-Sight
ELT	Emergency Locator Transmitter
EM	Electromagnetic
EMC	Electromagnetic Compatability
EMCON	Emissions Control; i.e., limited use of active radars, communication, data links, and other RF radiations
EMI	Electromagnetic Interference
EMP	Electromagnetic Pulse
EO	Electo-optics
EOI	Electro-optical Interference
EP	Electromagnetic Particles
EPI	Electromagnetic Particle Interference
ERAPS	Expendable Reliable Acoustic Path System; a long range active sonobuoy
ERP	Effective Radiated Power
ESG	Electrostatically Suspended Gyro
ESM	Electronic Support Measures (passive detections of enemy radiations)
ESR	Executive Service Requests
EW	Electronic Warfare
3F	Form, Fit, and Function
FAB	Foreign Array Buoy
FBW	Fly-by-Wire
FCS	Flight Control System

FDM	Frequency Division Multiplex
FFBD	Functional Flow Block Diagram
FIFO	First In/First Out
FLIR	Forward Looking Infrared
FLTSATCOM	Fleet Satellite Communications
FMOP	Frequency Modulation on Pulse
FO	Fiber Optics
FO	Fail Operation
FOM	Figure of Merit
FOTG	Fiber Optics Task Group
FPA	Focal Plane Array
fps	feet per second
FS	Fail Safe
FSD	Full Scale Development
FSK	Frequency Shift Keying
FTAS	Fast Time Analyzer System
FY	Fiscal Year
GAC	Grumman Aerospace Corporation
GCSS	Generalized Computer System Simulator
GFE	Government Furnished Equipment
GIUK	Greenland-Iceland-United Kingdom Gap
GPIM	General Purpose Interface Module
GPMS	General Purpose Multiplex System
GPS	Global Positioning System
GSE	Ground Support Equipment
HARM	High Speed Anti-Radiation Missile
Helo	Helicopter
HF	High Frequency
HFIC	High Frequency Intra Task Force Communications
HMFD	Horizontal Situation Multi-Function Display
HOJ	Home On Jamming
HOL	Higher Order Language
HPA	Horizontal Planar Array
HUD	Head Up Display
HULTEC	Hull-to-Emitter Correlation
HVDC	High Voltage DC
IACS	Integrated Acoustic Communications System
IAT	Integrated Avionics Technology
ICS	Intercom System
ID	Identification
IFF	Identification Friend Or Foe
IFIM	In-Flight Integrity Management Subprogram
IFM	Instantaneous Frequency Measurement
IFPM	In-Flight Performance Monitor
IFR	Instrument Flight Rules, flight conditions applicable to bad weather operations
IFR	In-Flight Refueling
IEWS	Integrated Electronic Warfare System
IISA	Integrated Inertial Sensor Assembly

I-Level	Intermediate Level
ILS	Instrument Landing System
ILS	Integrated Logistics Support
IM	Interface Module
INS	Inertial Navigation System
I/O	Input/Output
IOC	Initial Operating Capability
IPB	Illustrated Ports Breakdown System
IR	Infrared
IRCM	Infrared Countermeasures
IRSS	Infrared Search Sensors
ISA	Inertial Sensor Assembly
ISS	Integrated Sensor System
IWT	Integrated Weapon Teams
J/S	Jam-to-Signal
JTIDS	Joint Tactical Information Distribution System
KOPS	Thousand operations per second
KW	Kilo-watt
LAMPS	Light Airborne Multi-Purpose System
LCC	Life Cycle Cost
LCD	Liquid Crystal Display
L/D	Lift/Drag
LHA	Landing Helicopter, Amphibious
LED	Light Emitting Diode
LMICS	Logistic Management Information and Control
LOB	Line of Bearing
LOFAR	Low Frequency Analysis and Recording
LOR	Level of Repair
LORAN	Long Range Navigation System (wide area, 1 MHz RF region)
LOS	Line-of-Sight
LPI	Low Probability of Intercept
LRM	Long Range Missile
LSA	Logistic Support Analysis
LSI	Large Scale Integration
MA	Marine Assault
MAD	Magnetic Anomaly Detector
MADC	Machine assisted Detection and Classification
MADTACS	MAD Tactical Automatic Compensation System
MAP	Modular Avionics Package
MATE	Modular Automatic Test Equipment
MCAR	Multi-Channel Acoustic Relay
MCJR	Multi-Channel Jezebel Relay
MDT	Mean Down Time
MEATBALL	Optical Landing Aid
MERSHIPS	Merchant Ships
MFD	Multi-Function Display
MFHBF	Mean Flight Hours Between Failures

MIL-STD	Military Standard
MODEM	Modulation/Demodulation
MPD	Multi-Purpose Display
MRM	Medium Range Missile
MSP	Multi-Sensor Processor
MSS	Moored (acoustic) Surveillance System
MTBF	Mean Time Between Failures
MTI	Moving Target Indicator
MTTR	Mean Time-to-Repair
MUX	Multiplex
N/A	Not Applicable
NAC	Naval Avionics Center (NAFI)
NAEC	Naval Air Engineering Center
NAFI	Naval Air Facility, Indianapolis
NARF	Naval Aviation Rework Facility
NATO	North Atlantic Treaty Organization
NAV	Navigation
NAVAIDS	Navigation aids
NAVAIR	Naval Air Systems Command
NAVAIRDEVCEN	Naval Air Development Center
NAVELEX	Naval Electronics Facility
NAVAVIONICSFAC	Naval Avionics Facility
NAVTOLAND	Navy Vertical Takeoff and Landing Program
NAVSTAR	Navy's Global Position System
NB	Narrowband
NBSA	Narrowband Spectrum Analysis
NM	Nautical Mile
NMRG	Nuclear Magnetic Resonance Gyro
NORS	Not Operationally Ready - Supply
NOSC	Naval Ocean Systems Center
NRL	Naval Research Laboratory
NTDS	Naval Tactical Data System
NWC	Naval Weapons Center
OJT	On-the-Job Training
O-Level	Organization Level
OLS	Optical Landing System
OMEGA	World Wide Long Range Navigation System (10KHz RF Region)
OPCON	Operational Concept
OR	Operational Requirements
ORADS	Optical Ranging and Detection System
ORICS	Optical Ranging Identification and Communication System
OSD	Operational Sequence Diagram
OTC	Officer in Tactical Command
OTH	Over-the-Horizon
Ø	Phase
PC	Power Controller
Pd	Probability of Detection
PDIP	Preflight Data Insertion Program
PDP	Pilot Display Panel
PGS	Power Generation Subsystem

PGSE	Peculiar Ground Support Equipment
PIM	Position and Intended Movement
PIXEL	Picture Element
PK	Probability of Kill
PMA	Program Manager, AIR
PPI	Plan Position Indicator
PRF	Pulse Repetition Frequency
PROC	Processor
PROTEUS	Navy Standard High Speed Sensor Processor
QA	Quality Assurance
R&D	Research and Development
RCS	Radar Cross Section
RF	Radio Frequency
RLG	Ring Laser Gyro
RMA	Reliability, Maintainability, Availability
R&M	Reliability & Maintainability
RECCE	Reconaissance
RECON	Reconaissance
RFI	Request for Information
RFP	Request for Proposal
RFQ	Request for Quote
ROA	Radius of Action
ROC	Required Operational Capability
R/T	Receive/Transmit
RTB	Return to Base
SA	Surface Attack
SAG	Surface Action Group
SAM	Surface-to-Air Missile
SAM	Standard Aviation Module
S&RE	Suspension and Release Equipment
SAR	Synthetic Aperture Radar
SAR	Search and Rescue
SBA	Sea-Based Air
SCAS	Stability and Control Augmentation System
SCT	Self Contained Test
SDLM	Standard Depot Level Maintenance
SEC	Second (Time)
SEM	Standard Electronic Module
Sig	Signal
SIU	Store Interface Unit
SLAT(T)	Surface Launched Air Targeted Missile (Torpedo)
SLEP	Service Life Extension Program
SLOC	Sea Lines of Communication
SMP	Stores Management Processor

SMS	Stores Management System
SNA	Soviet Naval Aviation
SOA	Speed of Advance
SOS	Shipboard Operational Support
SONO	Sonobuoy
SOSS	Ship Operational Support Simulator
SOSTEL	Solid State Electric Logic
SOSUS	Sound Surveillance System, a land-based, long-range submarine detection system
SPA	SOSUS Probability Area; an area of the ocean that is thought to contain a submarine contact
SPEC	Specification
SPL-1	Signal Processing Language - One
SRA	Shop Replaceable Assembly
SRE	Suspension and Release Equipment
SRS	Sonobuoy Reference System
SSAC	Source Selection Advisory Council
SSM	Surface-to-Surface Missile
SSNCDS	Nuclear attack submarine employed in direct support of a surface ship task force
SSSC	Surface, Subsurface, Surveillance and Control
STN	System Track Number
STO	Short Takeoff
STP	Shielded Twisted Pair (Cable)
STOL	Short Takeoff and Landing
STS	Shipboard Tactical Support
SUB	Submarine
SUS	Sound Underwater Signal
SVLAD	Steered Vertical Line Array DIFAR
TACAN	Tactical Air Navigation
T&E	Test & Evaluation
TACCO	Tactical Coordinator (ASW operations)
TASS	Towed Array Sonar System; towed by surface ships and used for passive detection of submarines
TAW	Tactical Air Warfare
TBD	To Be Decided
TDM	Time Division Multiplex
TDS	Tactical Data System
TFCC	Tactical Flag Command Center
TGT	Target
TIES	Tactical Information Exchange System
TLR	Top Level Requirements
TOA	Time of Arrival
TOGW	Take-off Gross Weight
TOS	Time on Station
T/R	Transmit/Receive
TRISAT	Target Recognition Integration thru Spectral Analysis Techniques
TSC	Tactical Support Center, ship based ASW data processing center that supports airborne ASW operations
TTL	Technology Transition Laboratory
TTY	Teletype

UAM	Underwater Launched Anti-Air Missile
UHF	Ultra High Frequency
UK	United Kingdom
μp	Microprocessor
VAST	Versatile Avionics Shop Test
VAWX	E-2C Replacement
VFOC/RS	Fleet Operational Concept Requirements Study
VFR	Visual Flight Rule
VL	Vertical Landing
VLAD	Vertical Line Array DIFAR
VLSI	Very Large Scale Integration
VMFD	Vertical Situation Multi-Function Display
V-MODE	Vertical Mode
VOD	Vertical On-Board Delivery
VHF	Very High Frequency
VP	Fixed wing, land-based ASW aircraft
VS	versus
VSS	Future carrier for V/STOL aircraft
V/STOL	Vertical/Short Takeoff and Landing
V/STOL 'A'	Subsonic, multi-mission V/STOL aircraft used for ASW, AEW, COD, VOD and marine assault
V/STOL 'B'	Supersonic, high performance V/STOL aircraft for fighter and attack missions
VTAS	Visual Target Acquisition System
VTO	Vertical Takeoff
VTOL	Vertical Takeoff and Landing
WAM	Workload Assessment Model
WB	Wideband
WIDETRAC	Wide Transmission Relay Acoustic Communications
WO	Watch Officer
WRA	Weapons Replaceable Assembly
ZZ	A reference point marking the approximate center of a task force

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APPENDIX

V/STOL 'A' AVIONICS SYSTEM FUNCTIONAL HIERARCHY

INTRODUCTION

I. The V/STOL 'A' Avionics System Functional Hierarchy is a schematic, diagramatical complement to the system and subsystem concepts presented in Sections II and III. The conceptual avionics system examined in this text consists of the following nine subsystems:

- System Processing
- System Display and Control
- Electrical Power System Management
- Navigation
- Communications
- Flight Control System Management
- Sensors
- Countermeasures
- Stores Management

Figure 1 represents the wholistic relationship among these subsystems.

A functional tree diagram for each subsystem is shown and followed by a description of required functions and respective input requisites and output expectations. Except where specifically annotated as exclusively ASW or AEW, all functions are common to both mission configurations. The subsystem functions addressed in this appendix support and are referenced by the V/STOL mission scenario functional flow block diagrams in Section II (Requirements Analysis). Thus, V/STOL mission activities are related to specific avionic functions.

The functions represented herein have evolved through a V/STOL avionics system conceptualization process and are intended to identify V/STOL avionics system functional requirements. The functions or functional schematics are not meant to specify or suggest a particular system or subsystem architecture or design. Section III (Notional System Concepts) and Section IV (Technical Issues) present alternatives and trade-offs to concepts referred to in this appendix.

II. The following groundrules were adapted to facilitate standardization in the evolution of subsystem partitioning:

1. The communications subsystem performs the subsystem data transfer function for all subsystem.

2. The navigation receivers are considered as part of the navigation subsystem and not the communications subsystems.

3. The sensor receivers are considered as part of the sensors subsystem.

4. All sensor signal processing is done within the sensors subsystem.

5. Each subsystem performs its own initialization and recovery when directed by the system controller.

6. System processing is accomplished through a distributed processing system.

7. The stores management subsystem performs also as the V/STOL weapon and stores release subsystem.

8. The electrical power generation subsystem and environmental control subsystem are considered as part of the vehicle system and not the avionics system. These subsystems therefore, are not addressed in this document.

9. All operator initiated subsystem inputs, (data and command), are entered through the display and control subsystem. Initialize subsystem, configure subsystem, and weapon release exemplify typical subsystem inputs.

III. SUBSYSTEM FUNCTIONAL DESCRIPTION

1.0 System Processing

2.0 System Display and Control

3.0 Electrical Power System Management

4.0 Navigation

5.0 Communication

6.0 Flight Control System Management

7.0 Sensors

8.0 Countermeasures

9.0 Stores Management

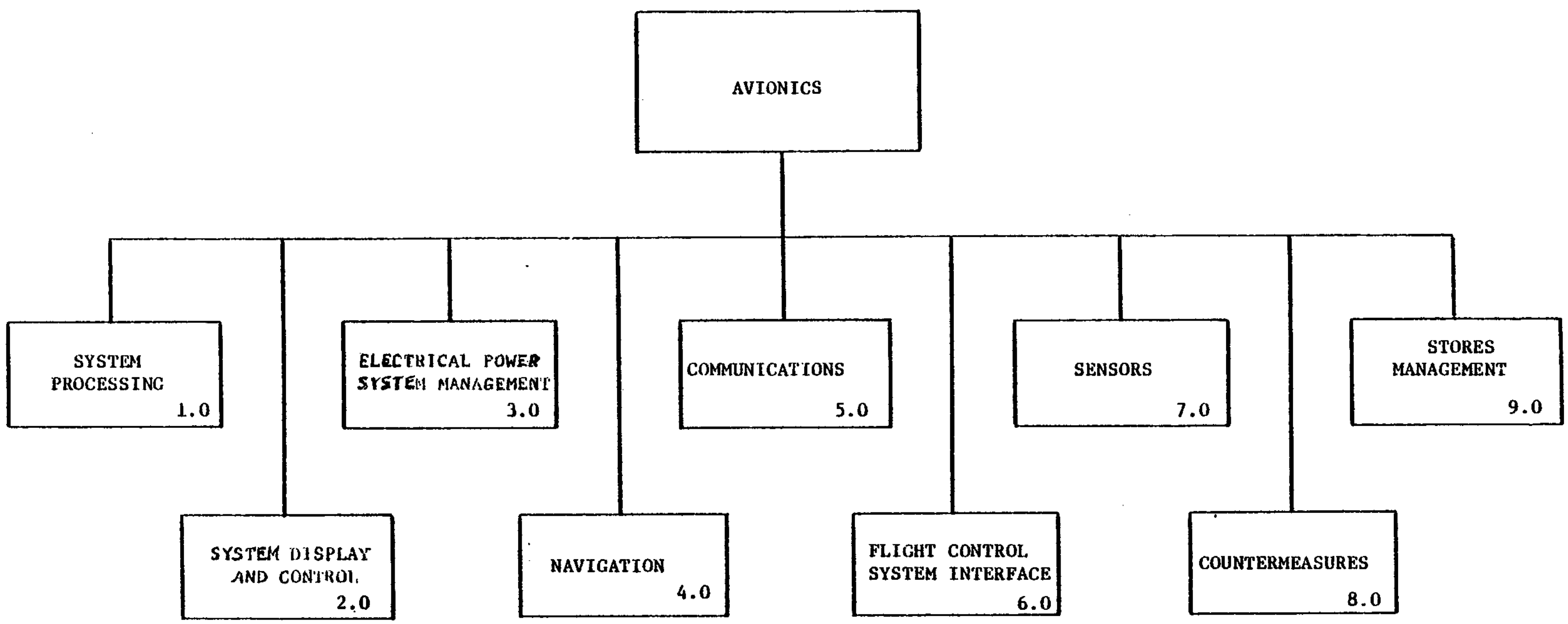


Figure IV-1

Avionics Functional Hierarchy

1.0 SYSTEM PROCESSING

Functional Description - The System Processing Subsystem performs two primary functions: Operational control of the subsystem processes and correlation of processed data output from the subsystems.

The System Processing Subsystem does not perform sensor processing functions or any processing functions unique to a subsystem (i.e., subsystem self test or signal processing). Partitioning into system processing and subsystem and sensor processing is basically a software partitioning. System processing and subsystem processing share the same computers. This distributed system processing subsystem is referred to as the system controller in this appendix.

Inputs: Command and data words from each of the V/STOL avionic subsystems.

Outputs: Control and monitoring of the V/STOL mission support functions of:

Initialization

Recovery

System Configuration

Operational Control

Mission Recording

Tactical Algorithm

Information Correlation and Resolution

Auxiliary Support

Safety System

Operating System

1.1 INITIALIZATION

Functional Description - The initialization function of the V/STOL avionics is composed of the following subfunctions:

a. Initial Checkout - The avionics initialization controller (any of the processors) is loaded from a load device containing unit test software designed to verify the integrity of the system. Self test is performed internally by the controller and includes the CPU and external memories. Loop tests are conducted between the controller and the individual avionics subsystems in order to verify the communication links. Configuration data, which establishes the various operating modes of the subsystem elements, is loaded from the initialization controller into each of the avionics subsystems. Alarm test conditions are initiated from sensors aboard the V/STOL in order to ensure system fault detection, (i.e., hydraulic system failure, electrical fault or an engine fault). The initial checkout process includes a verification that a fault is sensed and reported to an appropriate display. The system controller directs each subsystem processor to execute its built in test function and report the results back for appropriate display. The system controller tabulates the results received from the initial checkout process and reports the checkout as being either go or no-go. A no-go report will effect a system shutdown.

b. System Test - The system test subfunction requires a hardware diagnostic program to be run for the total system, including subsystem interfaces and each subsystem. The system test verifies the proper operation of the equipment in the system and reports as to the proper operation or malfunctioning of a specific subsystem. The system test isolates the problem within the malfunctioning subsystem to a specific subunit or group of pages that can be replaced in order to rectify the problem.

c. Program Load - Following a successful initial checkout and system test, the operational software is loaded into the system controller which in turn, loads each of the subsystem processors with their respective operational software. Each subsystem reports the successful loading of its operational software to the system controller.

d. Data Load - The V/STOL aircraft are provided with data on magnetic tape which permits optional configuration for prosecution of designated targets. The data includes target classification information (i.e., frequency components, radar characteristics), desired operating modes for each of the subsystem processors, position of friendly forces, etc. This data will be made available by the Tactical Ship Support for the V/STOL before each mission. In addition, data will be supplied to a relief V/STOL aircraft by the aircraft currently on station.

e. Avionics Initialization - The avionics subsystems must be initialized to a specified state before the operational software is executed. The system controller will issue the required commands to each of the subsystems to place these subsystems in the required state. Failure to perform this initialization function will cause the software operating system to report a software system error.

Inputs - System Load Data which contains: commands to initiate self tests, a hardware diagnostic program, operational software, and a priori and initialization data for the system and all subsystems.

Outputs - Status on the results of all tests and an indication of whether the software has been loaded and initialized successfully, reported out to the display and control subsystem.

1.2 RECOVERY

Functional Description - The recovery function provides for the contingency that when a subsystem fails, and this failure is recognized and isolated by the in-flight performance monitoring software, the system can be reconfigured either automatically or manually into a degraded mode and the mission can proceed. The system will display the possible degraded mode configurations along with the resultant mission impact upon the selection of each of these configurations. The operator will select the desired configuration, at which time the system will proceed with the initialization function (see 1.1). At the completion of the initialization process, the system will enter the information contained in the checkpoint status data base. This data base contains subsystem configuration status information which includes the operating mode for each processor and stores inventories; and problem data which includes tactical display inputs, sensor classification coefficients, and navigation computations. At the completion of the recovery process, the system will display a message that the recovery has been successful along with the resultant degraded configuration.

Inputs - System load data that was used for the initialization function (see 1.1) with the system configuration modified to support the new degraded system and a checkpoint data base which contains the system status data and problem data at the time that the system failed.

Outputs - The system operating in a degraded mode (less the function that failed) with a fault free condition being reported by the system to the display.

1.3 SYSTEM CONFIGURATION

Functional Description - The system is required to maintain status with each of the subsystem processors to verify that the communication link is operating properly and that the subsystem is properly configured. The system will format and receive messages, as scheduled by the executive, to verify the configuration status of each of the subsystems and peripherals. The system also has the capability to reconfigure any of the subsystems to a new configuration.

Recovery data in the form of configuration status and problem data is periodically collected by the system from each of the subsystems and stored on magnetic tape (or other medium). This recovery data is used by the system to restore mission operation after a system/subsystem failure (see 1.2).

In addition to monitoring the configuration status of each subsystem, the system also monitors the vehicle status. Such parameters as fuel status, attitude and temperature are monitored and displayed.

In the case of a failure of the system controller, the operator will designate, via a keyset entry, another subsystem CPU to assume the function of system controller. The initialization and recovery procedures will then take place, to load and configure the system in a new degraded mode.

Inputs - Requests for operating status of subsystems and peripherals, for changes to subsystem configurations and for collection of system recovery data.

Outputs - System and subsystem configurations are as requested, and system contains current recovery data.

1.4 OPERATIONAL CONTROL

Functional Description - The operational control of the mission is concerned with the following subfunctions:

a. Coordination of sensor operation, such that the sensors are not interfering with one another (i.e., ESM and Radar) and that they are providing the required complementary coverage. Also provided for is the modification of initialized apriori data due to mission observations.

b. Ground support aids, such as: power, environmental control and briefing/debriefing. The ground support also provides verification of the software load path to the system CPU.

c. Environmental status and prediction, which concerns weather, air traffic and predicted operating range of sensors.

d. Mission status, which includes the current progress of the mission in relation to its objective, the probability of the mission being successfully completed (i.e., projected fuel consumption), and the prediction of potential safety hazards if the mission proceeds as scheduled.

e. Maintaining the mission parameters of other air vehicles which are under the operational control of the V/STOL aircraft. These parameters include vehicle performance (i.e., air speed, altitude and fuel consumption), stores inventories and sensor data input. The V/STOL would have to supply these vehicles with navigation headings (to enable them to reach their mission destination) and stores release information. This subfunction would also apply to surface launched air targeting of a missile (SLAT), where the V/STOL would supply navigation targeting data to a surface ship launched missile. The capability for both the control of other aircraft and for SLAT applies only to the AEW V/STOL aircraft.

f. Fire control, using inputs from the navigation, sensors, stores management and flight control subsystems. Computations will be made for optimum weapon fly-to-points and time of release for weapons and buoys. System processing will perform all the needed subsystem correlation calculations to enable a fire control solution.

Inputs - Mission requirements, mission status, and ground support.

Outputs - Coordination of mission functions and adequate monitoring of mission parameters.

1.5 MISSION RECORDING

Functional Description - The V/STOL system will extract data collected during the mission and record it on magnetic tape to provide for a thorough debriefing (post flight analysis) of the mission scenario. Events will be recorded automatically by the system that are concerned with: tactical data, processed sensor data, system and subsystem configuration status, flight parameters, and any subsystem failures. Along with each block of data recorded, the system will also record the time of the event. In addition, any other event of interest can be recorded aboard the aircraft through manual intervention by an operator (via the keyset).

Inputs - Data collected by the V/STOL subsystems.

Outputs - A digital record on magnetic tape which contains data collected during the mission.

1.6 TACTICAL ALGORITHM COMPUTATION

Functional Description - The system will compute the optimum location for sonobuoy deployment based upon environmental parameters (i.e., ambient sea noise level and water temperature) measured on station, and apriori data (i.e., target location and source level), that was entered into the system at initialization time. The system will use sensor contact data received to classify the target, by comparing the contact parameters (i.e., acoustic frequency or radar pulse repetition period) against known target parameter tables that were stored as part of the apriori data. Best classification matches will be obtained along with the associated probabilities. An alert will be issued for any targets classified as hostile. Target fixes (estimated range and bearing) will be used to compute the location and track of the target along with the uncertainties. A time contact history will be maintained on each target to enable the system to compute the target's track. The operator may select any target to attack, at which time the system will compute a weapon release envelope and a "probability of kill." In addition, for each hostile target detected, which is known to have a capability of attacking the V/STOL, the system will compute both target detection and weapon avoidance envelopes.

The system will maintain an updated tactical situation plot showing the location of all detections in relation to the deployment of the friendly forces.

Inputs - Reports of target contacts from V/STOL sensors and environmental parameters.

Outputs - Optimum deployment of sonobuoys and weapons; and target classification, location and track based upon individual sensor contacts.

1.7 INFORMATION CORRELATION AND RESOLUTION

Functional Description - Target contacts are reported by subsystems associated with V/STOL sensors. The subsystem reports supporting data with the contact such as emitted frequency, when detected, estimated location, and speed. The system will correlate this data along with the apriori information that was supplied by the Tactical Support Center and entered into the system during initialization. The system will compute the cumulative probabilities of target classification and the cumulative uncertainty associated with the target's location and track. Each target contact along with its classification and position parameters will be displayed by the system, and an alert (i.e., flashing display) will be issued for any target that is classified as hostile. A contact history will be maintained, and the display will indicate the last time that the target was detected. The system will provide for targets to be "aged" out of the system when there is no further contact for a specified period of time.

Inputs - Results of analysis of target contacts from the individual V/STOL sensors.

Outputs - Target classification, location and track based upon correlation of all sensor outputs.

1.8 AUXILIARY SUPPORT

Functional Description - It is desirable to customize the V/STOL aircraft system processing to the requirements for each mission. This includes providing the system with current apriori information, optimum system configurations, and exact stores inventories. A support software facility, which has the capability to link relocatable software object modules together, will provide the means to build a system load tape which contains all of the mission specific data. The support facility in addition would need the capability to build a relocatable object module containing the desired configurations and data. This module building would be accomplished through the use of available program generation tools such as an editor. A software build document would be available to the support facility, to provide direction on how to input the needed data into the system load tape.

Inputs - Software in relocatable object modules compatible with a relocatable link loader, and a software system load tape build document.

Outputs - System load data, which will be used to initiate the system and all subsystems (see 1.1).

1.9 SAFETY

Functional Description - Measurements are continually being made and displayed, concerning the physical condition of vehicle, engine and avionics systems. Hazardous conditions which affect safety of flight will be highlighted by a flashing display. The system will recommend an action to take to relieve the hazard (i.e., shutdown a certain subsystem). Some of the measurements to be made include: equipment temperatures, hydraulic pressure, and electrical voltage.

Inputs - Measurements of vehicle, engine and avionics equipment condition parameters.

Outputs - Results of equipment condition parameter measurements, and indication of any safety hazards.

1.10 EXECUTIVE

Functional Description - The executive is composed of a software program whose purpose is to control all mission functions and data base management. Subsystems can only communicate with other subsystems or an operator when they are scheduled by the executive is told, via initialization system configuration data, which mission functions are to be serviced on a regular time interval, and which functions will be serviced on a priority interrupt basis. In addition, interrupt priority levels are assigned based upon the criticality of the function in relation to the mission objectives.

The system clock is maintained by the operating system and it periodically issues an interrupt to the executive for the clock to be read. The executive will treat the clock interrupt on a high priority basis, since the time is needed for scheduling of specific system functions.

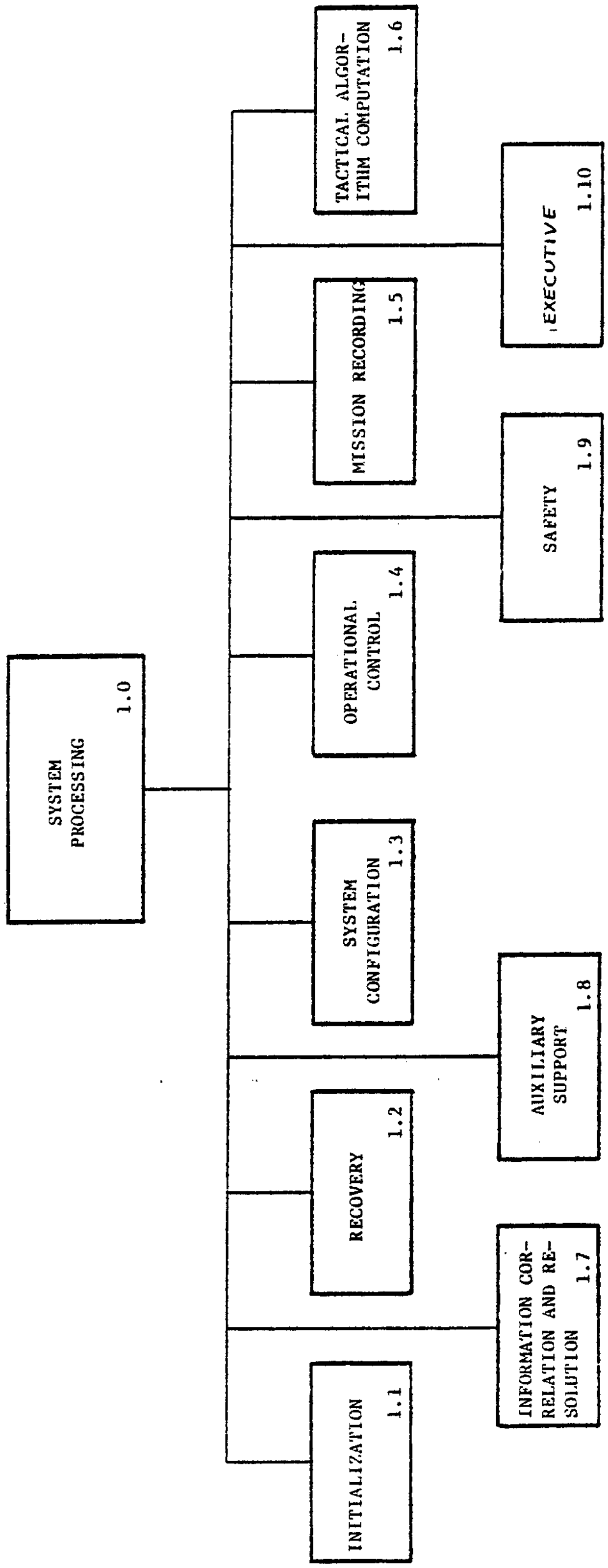
The operating system also has the task of allocating storage in the various memory units in the system, as requested by the operational software program. The operating system maintains a record of where in memory each piece of data is stored, and is responsible for retrieving data as needed.

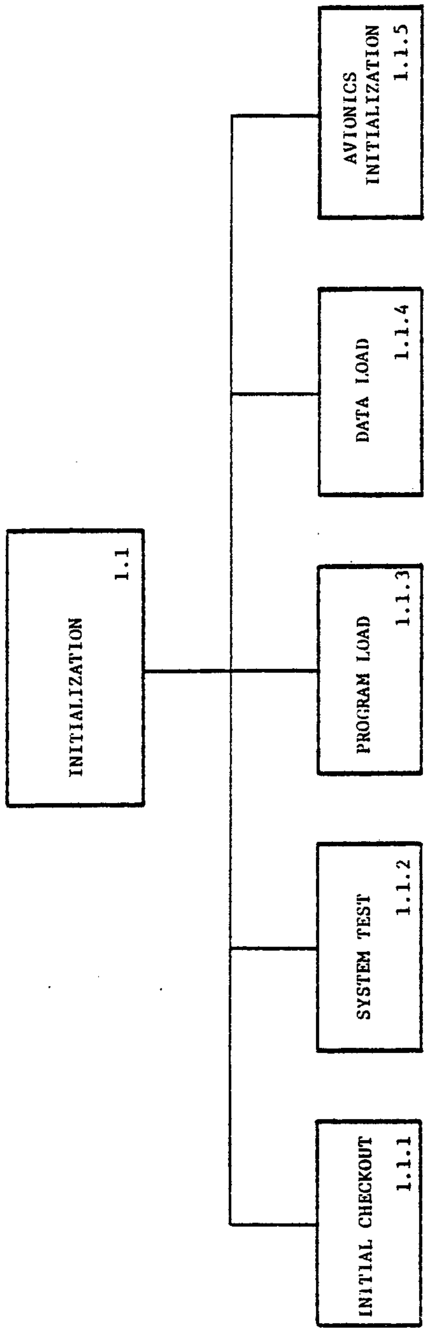
The operating system, in addition, is responsible for verifying the correct transmission/reception of each command or data word sent between processors or between processors and any of the system memory units. These communications (referred to as I/O) are verified through an operating system protocol such as echo-back, checksum or parity check.

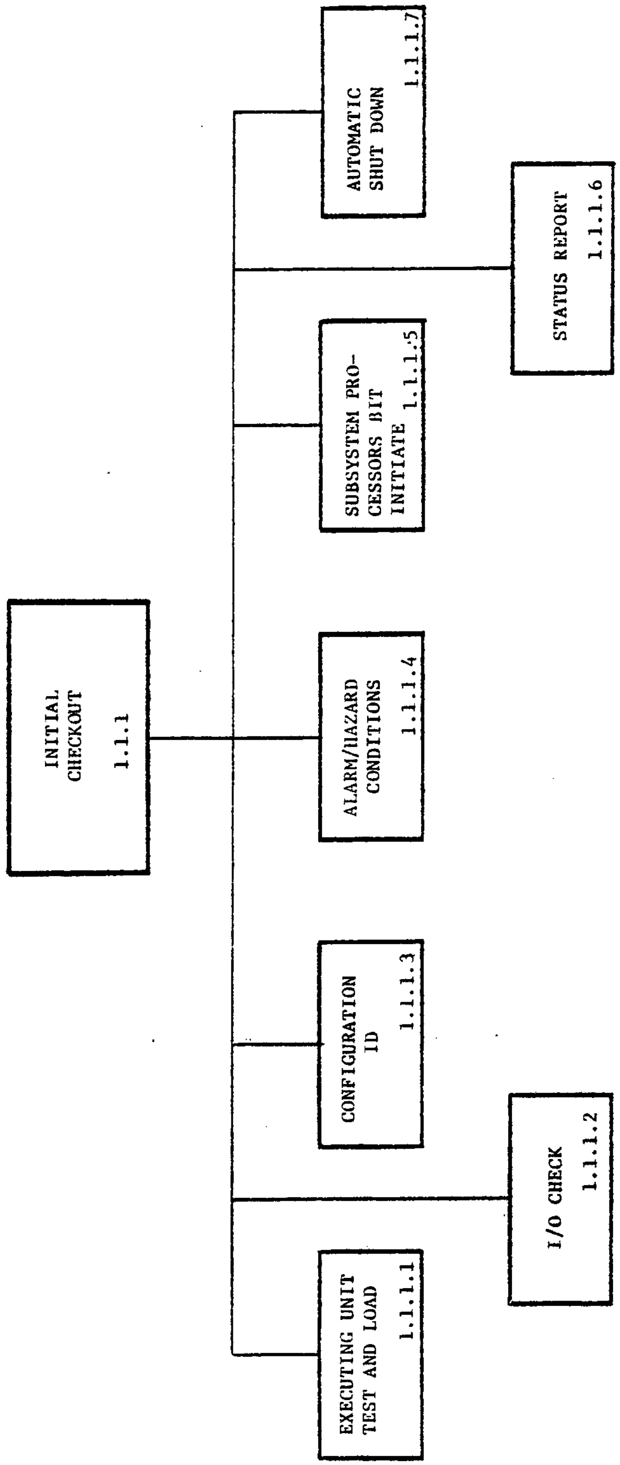
A subsystem common data base will be maintained within the system . This data base will contain parameters that are regularly needed by more than one subsystem, such as aircraft location and speed. These parameters would be transferred to the data base at specified time intervals by the subsystem responsible for the computation (i.e., the navigation subsystem would compute the aircraft's location and send it to the data base at the rate of five times per minute). The controller would interrupt those subsystems that are in need of this data and it will transmit the required parameters to each of the subsystems (i.e., the aircraft location would be supplied to the display, flight control and sensor subsystems).

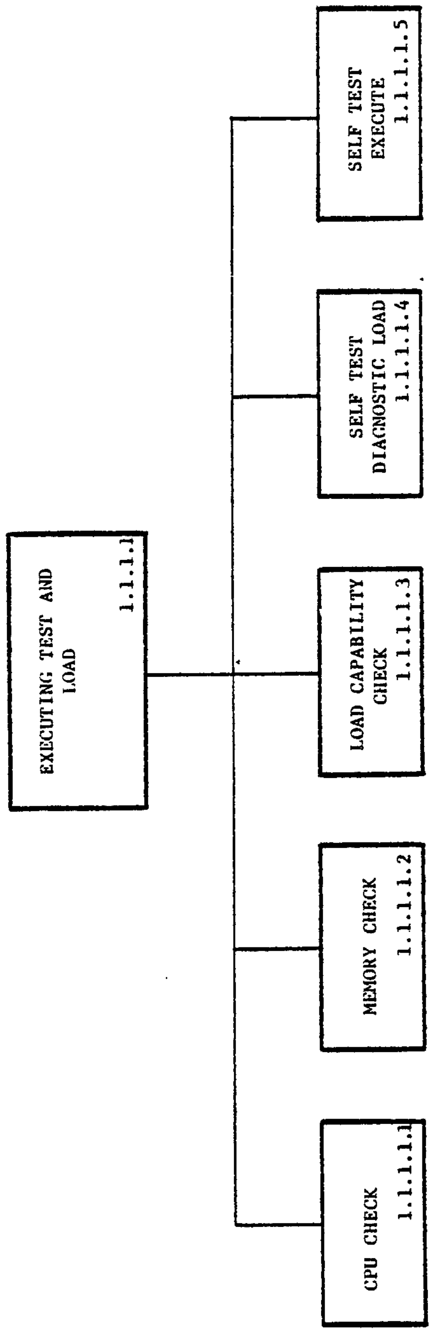
Inputs - Mission function processing requests.

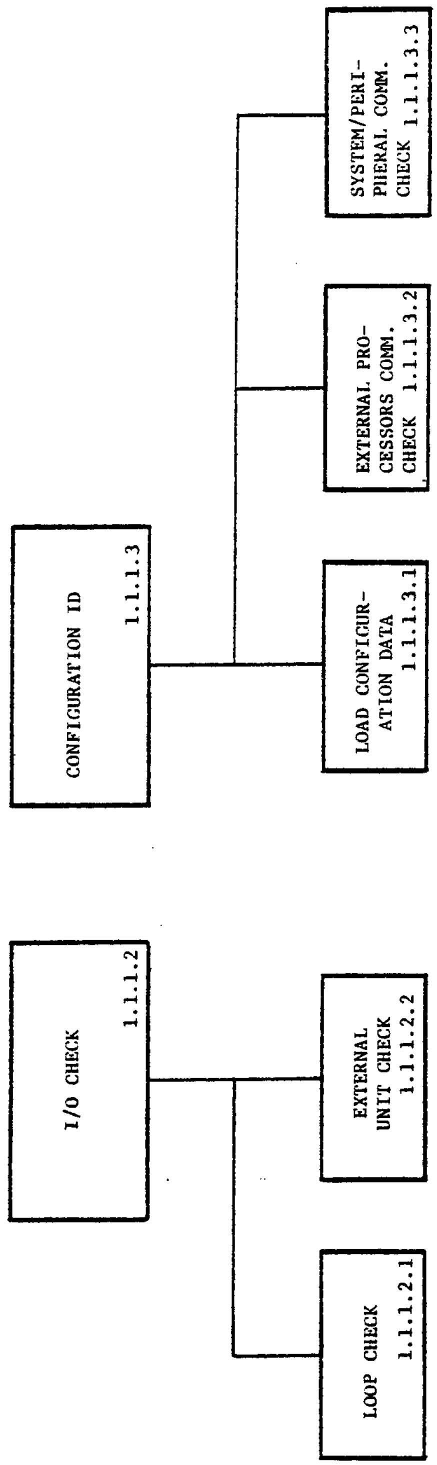
Outputs - Control of mission functions.


SYSTEM PROCESSING 1.0
INITIALIZATION 1.1
RECOVERY 1.2
SYSTEM CONFIGURATION 1.3
OPERATIONAL CONTROL 1.4
MISSION RECORDING 1.5
TACTICAL ALGOR- ITHM COMPUTATION 1.6
INFORMATION COR- RELATION AND RE- SOLUTION 1.7
AUXILIARY SUPPORT 1.8
SAFETY 1.9
EXECUTIVE 1.10

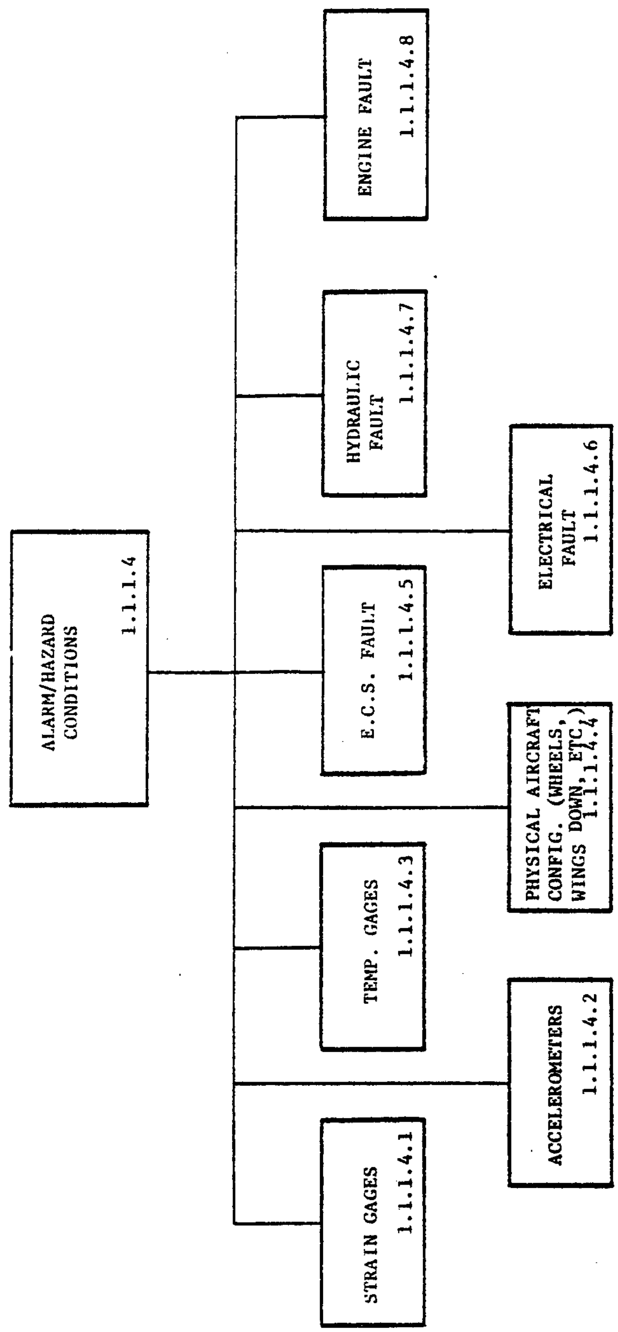

INITIALIZATION 1.1
INITIAL CHECKOUT 1.1.1
SYSTEM TEST 1.1.2
PROGRAM LOAD 1.1.3
DATA LOAD 1.1.4
AVIONICS INITIALIZATION 1.1.5

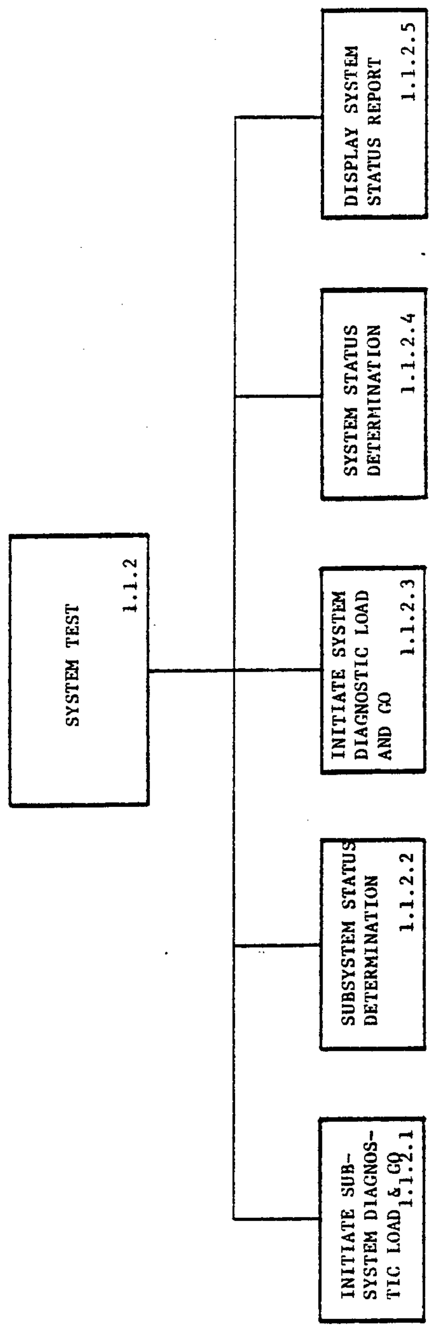

INITIAL CHECKOUT
1.1.1
EXECUTING UNIT TEST AND LOAD
1.1.1.1
I/O CHECK
1.1.1.2
CONFIGURATION ID
1.1.1.3
ALARM/HAZARD CONDITIONS
1.1.1.4
SUBSYSTEM PRO-CESSORS BIT INITIATE
1.1.1.5
STATUS REPORT
1.1.1.6
AUTOMATIC SHUT DOWN
1.1.1.7

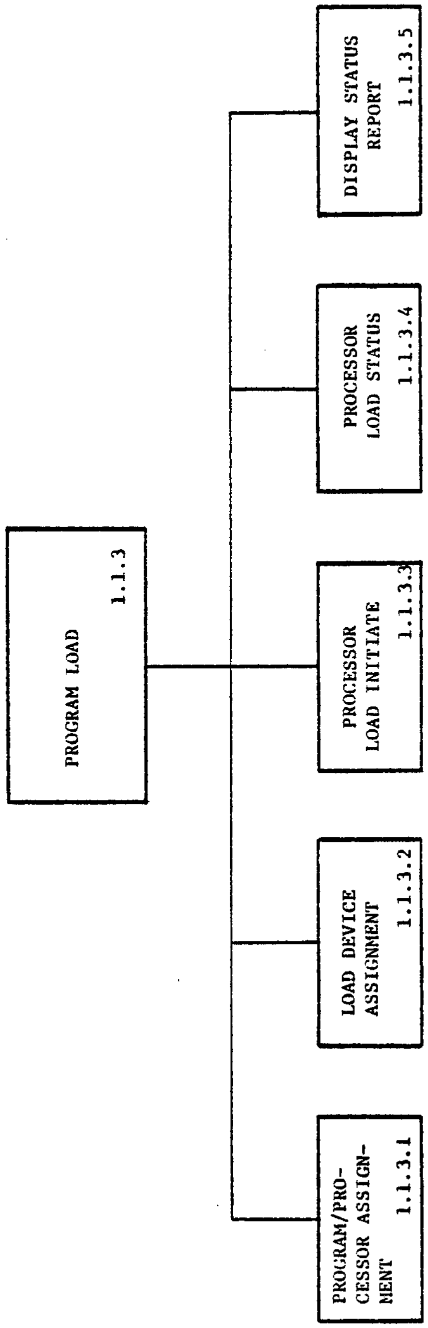

EXECUTING TEST AND LOAD
1.1.1.1
CPU CHECK
1.1.1.1.1
MEMORY CHECK
1.1.1.1.2
LOAD CAPABILITY CHECK
1.1.1.1.3
SELF TEST DIAGNOSTIC LOAD
1.1.1.1.4
SELF TEST EXECUTE
1.1.1.1.5

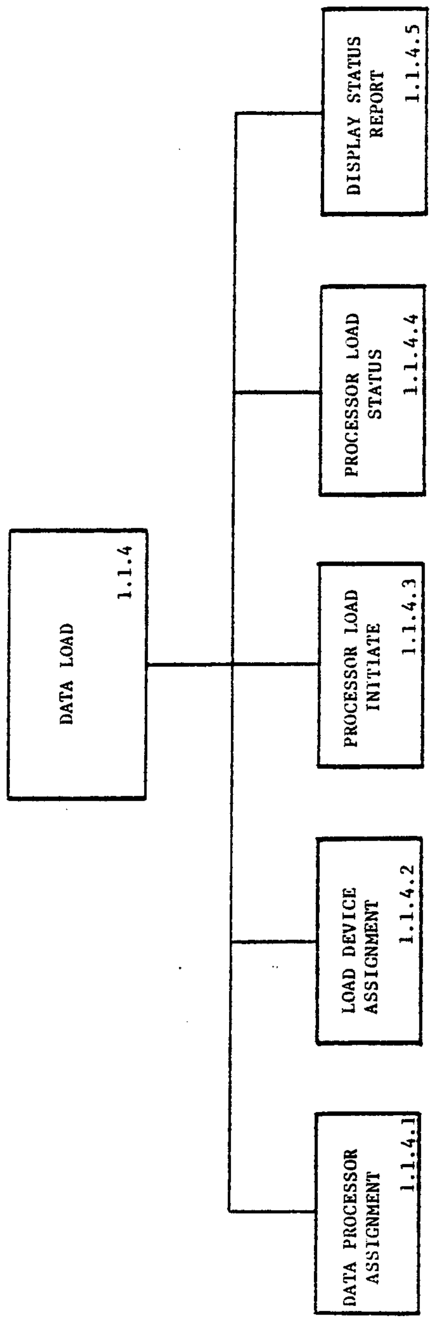


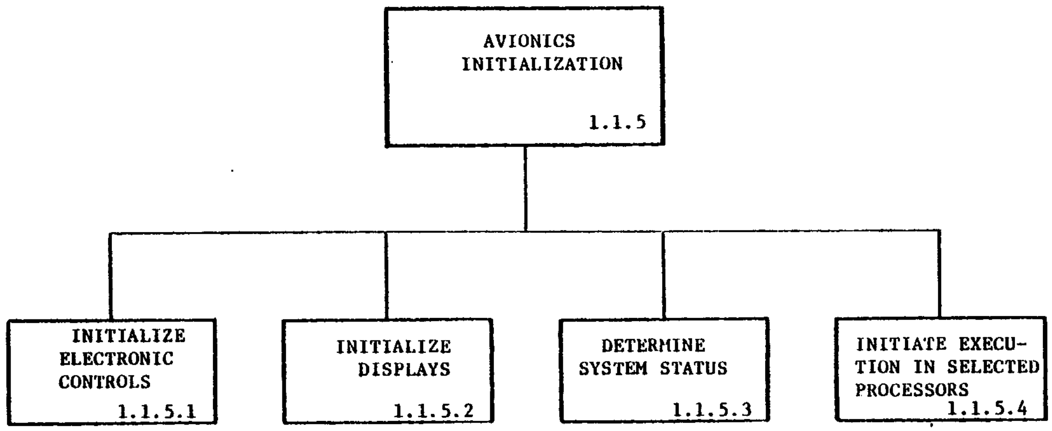
I/O CHECK 1.1.1.2
LOOP CHECK 1.1.1.2.1
EXTERNAL UNIT CHECK 1.1.1.2.2
CONFIGURATION ID 1.1.1.3
LOAD CONFIGUR- ATION DATA 1.1.1.3.1
EXTERNAL PRO- CESSORS COMM. CHECK 1.1.1.3.2
SYSTEM/PERI- PHERAL COMM. CHECK 1.1.1.3.3

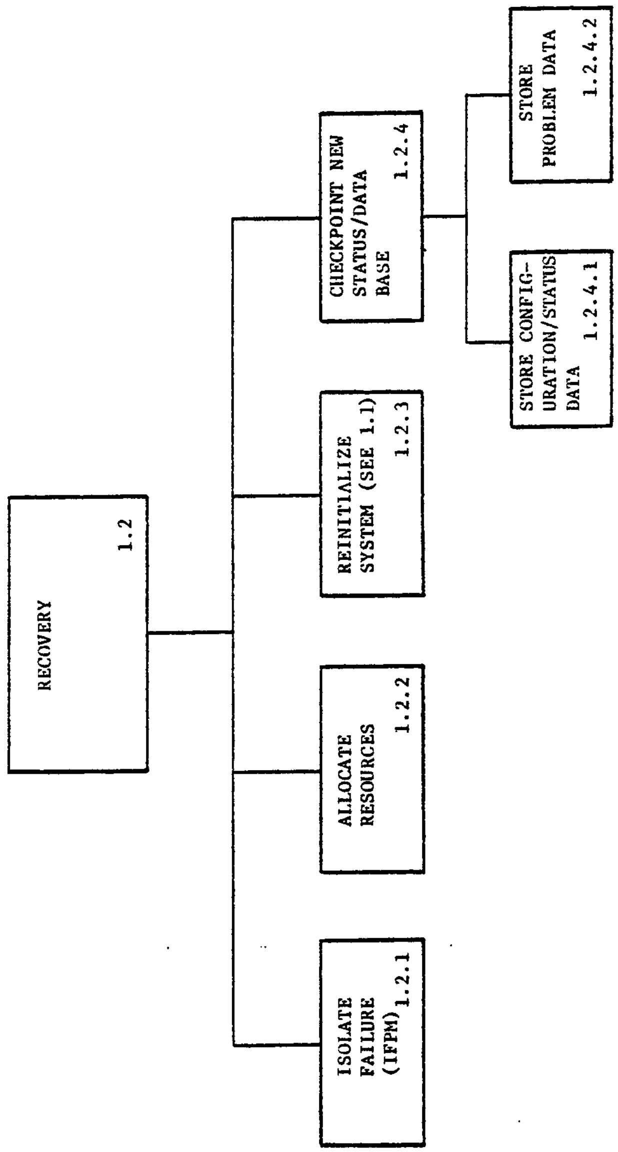

ALARM/HAZARD CONDITIONS 1.1.1.4
STRAIN GAGES 1.1.1.4.1
ACCELEROMETERS 1.1.1.4.2
TEMP. GAGES 1.1.1.4.3
PHYSICAL AIRCRAFT CONFIG. (WHEELS, WINGS DOWN, ETC.) 1.1.1.4.4
E.C.S. FAULT 1.1.1.4.5
ELECTRICAL FAULT 1.1.1.4.6
HYDRAULIC FAULT 1.1.1.4.7
ENGINE FAULT 1.1.1.4.8

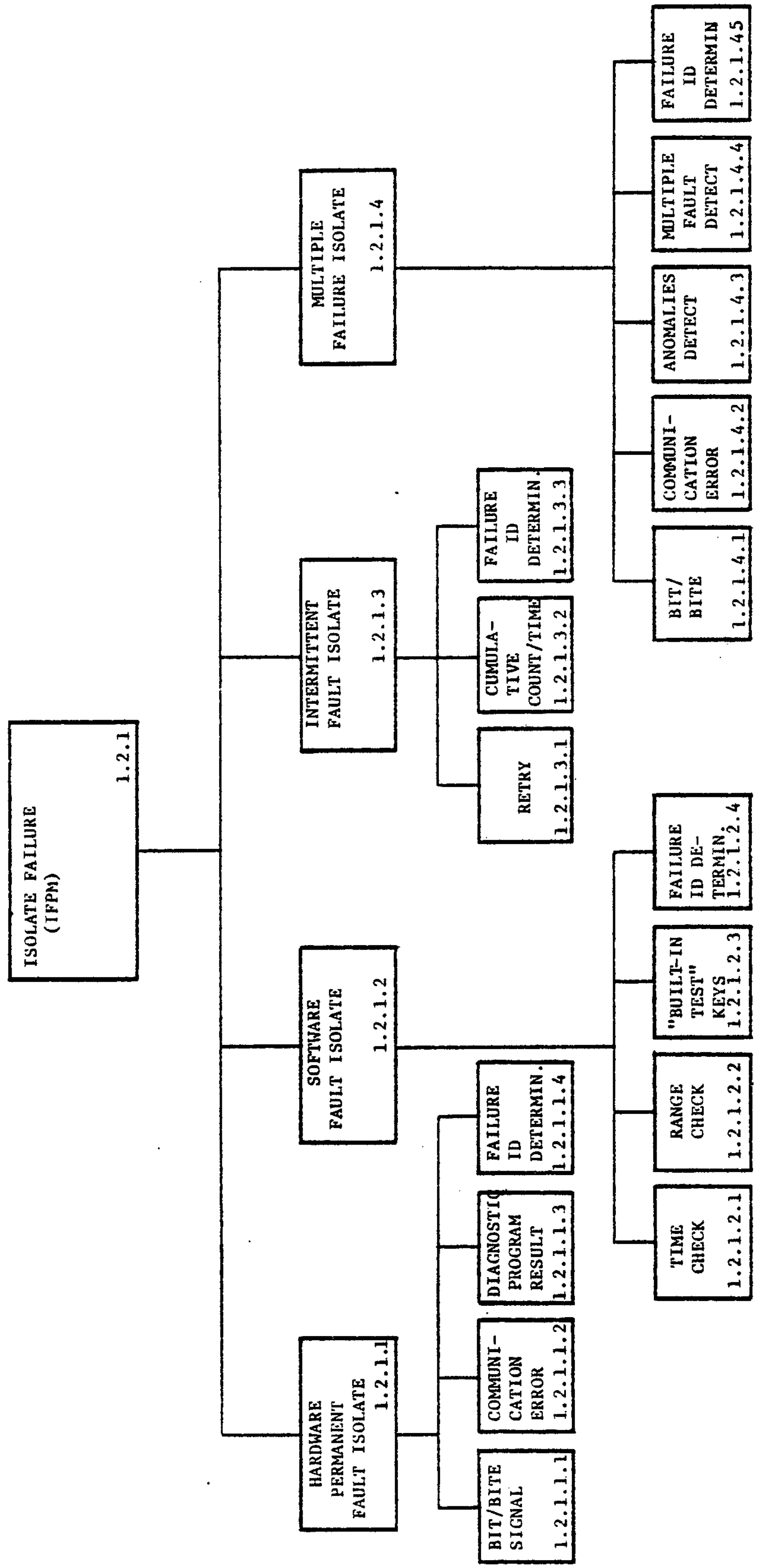

SYSTEM TEST
1.1.2
INITIATE SUB-
SYSTEM DIAGNOS-
TIC LOAD & GO
1.1.2.1
SUBSYSTEM STATUS
DETERMINATION
1.1.2.2
INITIATE SYSTEM
DIAGNOSTIC LOAD
AND GO
1.1.2.3
SYSTEM STATUS
DETERMINATION
1.1.2.4
DISPLAY SYSTEM
STATUS REPORT
1.1.2.5


PROGRAM LOAD 1.1.3
PROGRAM/PRO-CESSOR ASSIGN-MENT 1.1.3.1
LOAD DEVICE ASSIGNMENT 1.1.3.2
PROCESSOR LOAD INITIATE 1.1.3.3
PROCESSOR LOAD STATUS 1.1.3.4
DISPLAY STATUS REPORT 1.1.3.5


DATA LOAD
1.1.4
DATA PROCESSOR ASSIGNMENT
1.1.4.1
LOAD DEVICE ASSIGNMENT
1.1.4.2
PROCESSOR LOAD INITIATE
1.1.4.3
PROCESSOR LOAD STATUS
1.1.4.4
DISPLAY STATUS REPORT
1.1.4.5


AVIONICS INITIALIZATION
1.1.5
INITIALIZE ELECTRONIC CONTROLS
1.1.5.1
INITIALIZE DISPLAYS
1.1.5.2
DETERMINE SYSTEM STATUS
1.1.5.3
INITIATE EXECU- TION IN SELECTED PROCESSORS
1.1.5.4


RECOVERY 1.2
ISOLATE FAILURE (IFPM) 1.2.1
ALLOCATE RESOURCES 1.2.2
REINITIALIZE SYSTEM (SEE 1.1) 1.2.3
CHECKPOINT NEW STATUS/DATA BASE 1.2.4
STORE CONFIG-URATION/STATUS DATA 1.2.4.1
STORE PROBLEM DATA 1.2.4.2


ISOLATE FAILURE (IFPM) 1.2.1
HARDWARE PERMANENT FAULT ISOLATE 1.2.1.1
SOFTWARE FAULT ISOLATE 1.2.1.2
INTERMITTENT FAULT ISOLATE 1.2.1.3
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TIME CHECK 1.2.1.2.1
RANGE CHECK 1.2.1.2.2
"BUILT-IN TEST" KEYS 1.2.1.2.3
FAILURE ID DE-TERMIN. 1.2.1.2.4
RETRY 1.2.1.3.1
CUMULA-TIVE COUNT/TIME 1.2.1.3.2
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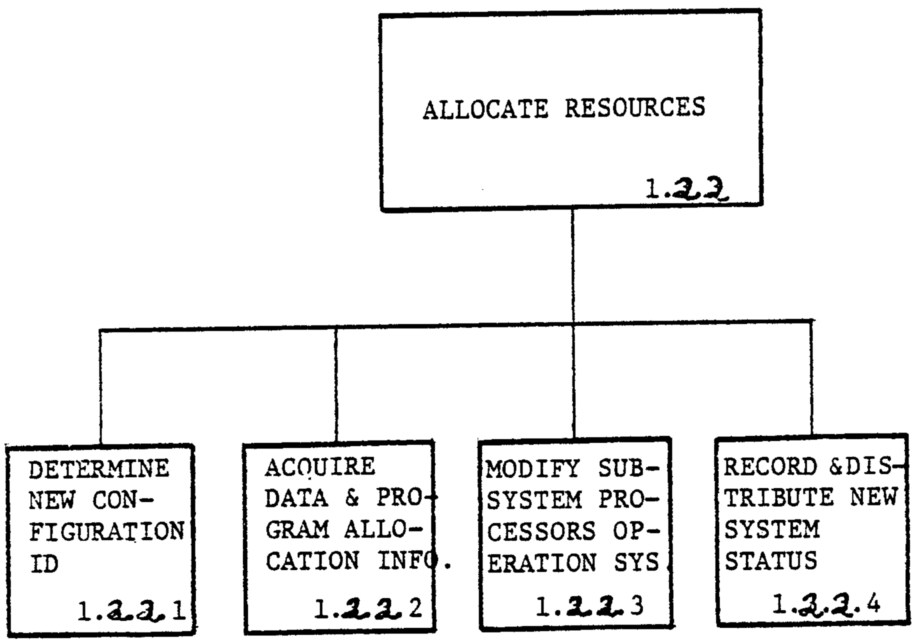
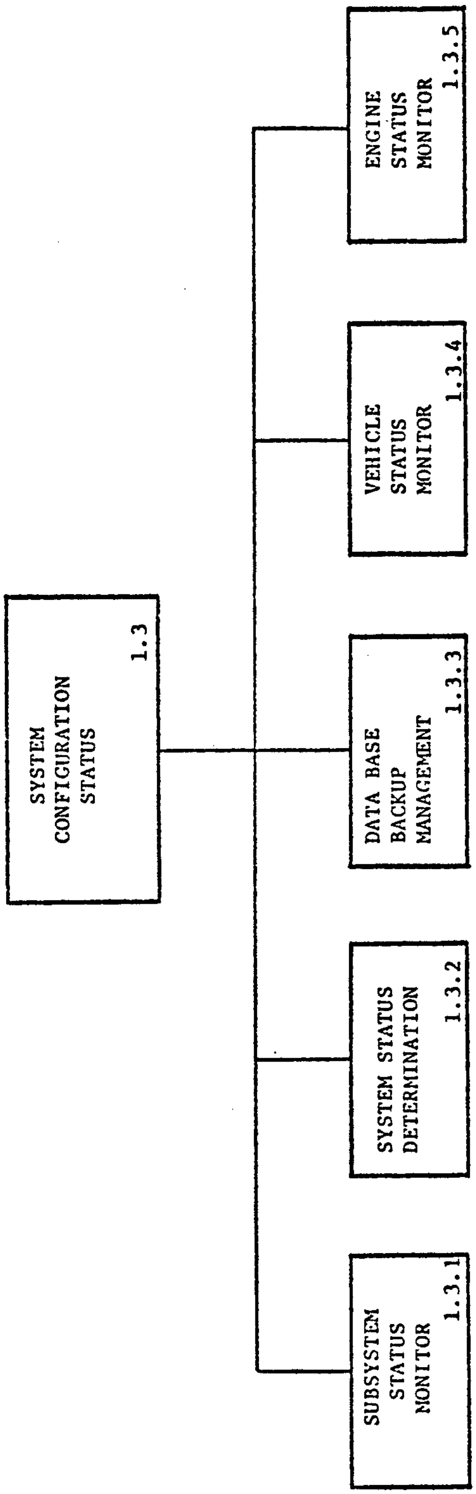
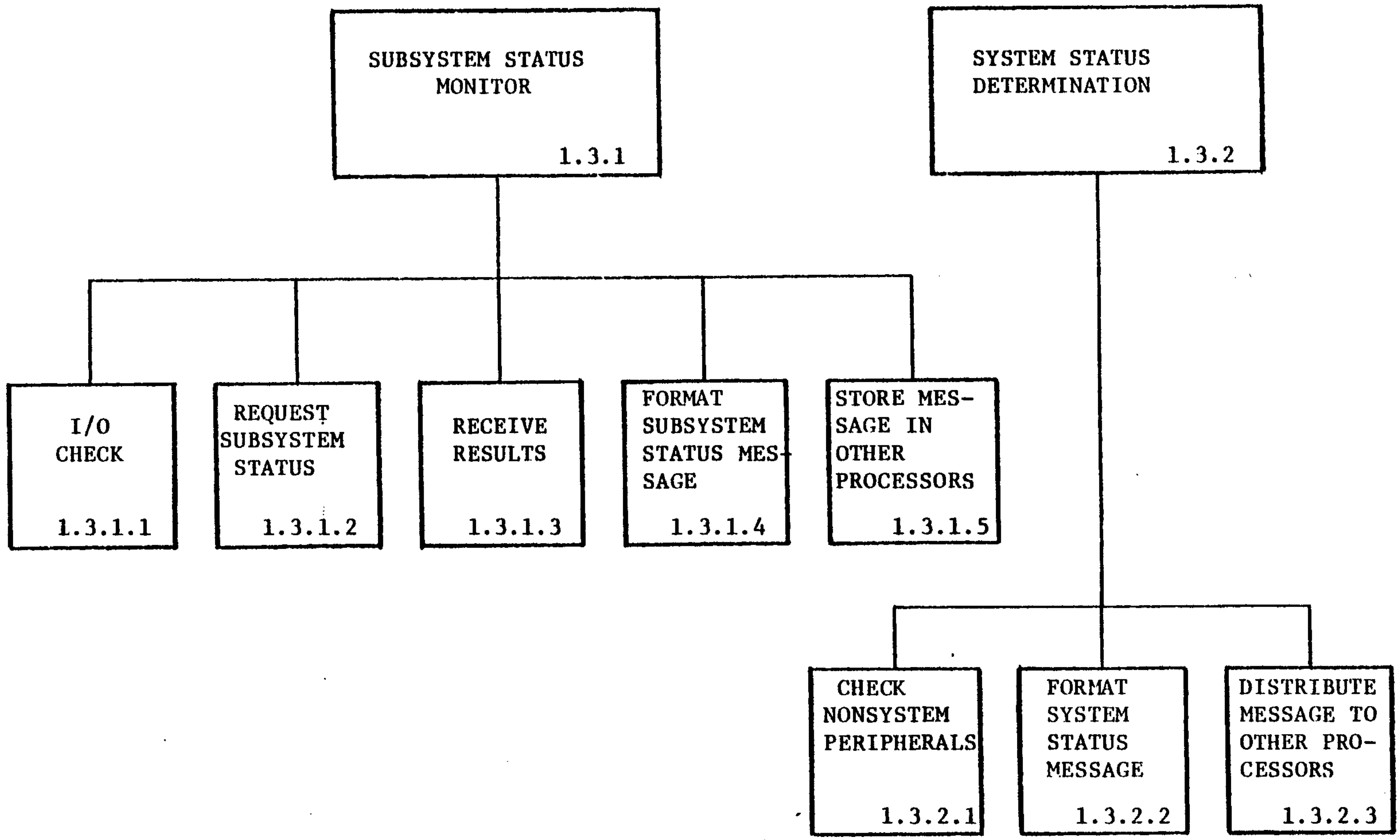
BIT/ BITE 1.2.1.4.1
COMMUNI-CATION ERROR 1.2.1.4.2
ANOMALIES DETECT 1.2.1.4.3
MULTIPLE FAULT DETECT 1.2.1.4.4
FAILURE ID DETERMIN 1.2.1.45


ALLOCATE RESOURCES
1.2.2
DETERMINE NEW CON- FIGURATION ID
1.2.2.1
ACQUIRE DATA & PRO- GRAM ALLO- CATION INFO.
1.2.2.2
MODIFY SUB- SYSTEM PRO- CESSORS OP- ERATION SYS.
1.2.2.3
RECORD &DIS- TRIBUTE NEW SYSTEM STATUS
1.2.2.4


SYSTEM CONFIGURATION STATUS 1.3
SUBSYSTEM STATUS MONITOR 1.3.1
SYSTEM STATUS DETERMINATION 1.3.2
DATA BASE BACKUP MANAGEMENT 1.3.3
VEHICLE STATUS MONITOR 1.3.4
ENGINE STATUS MONITOR 1.3.5


SUBSYSTEM STATUS MONITOR
1.3.1
SYSTEM STATUS DETERMINATION
1.3.2
I/O CHECK
1.3.1.1
REQUEST SUBSYSTEM STATUS
1.3.1.2
RECEIVE RESULTS
1.3.1.3
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1.3.1.4
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1.3.1.5
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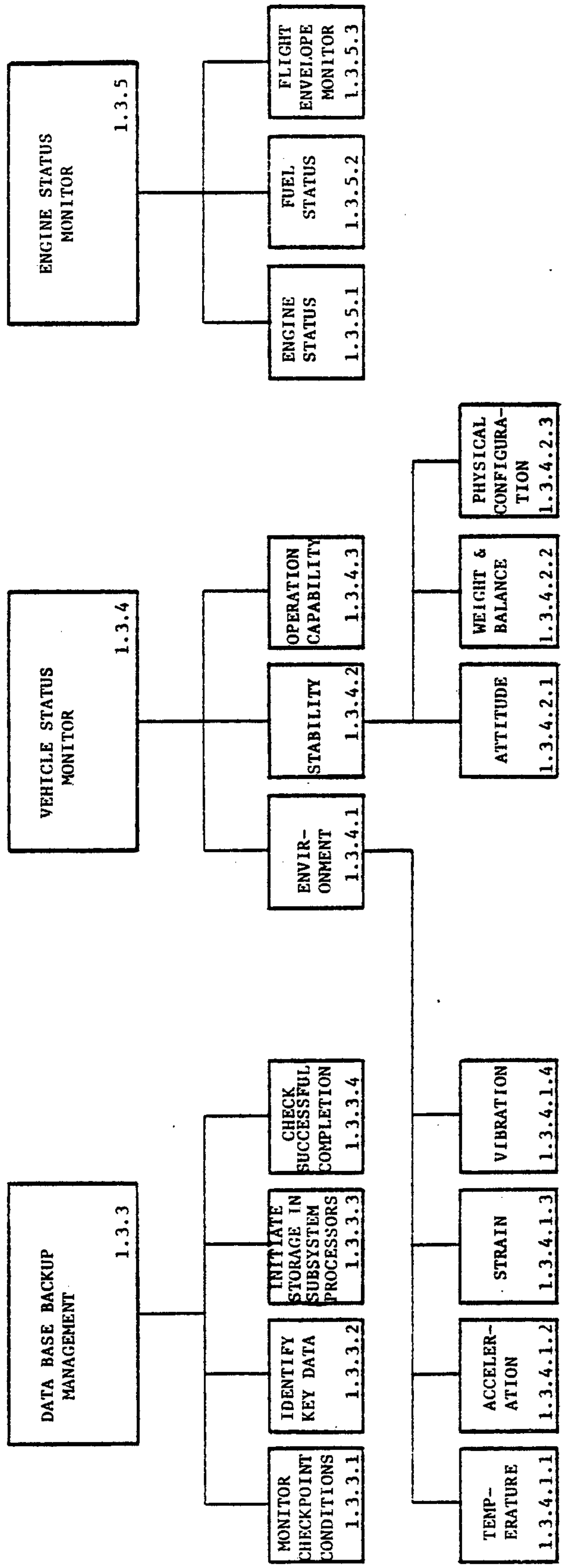
1.3.2.1
FORMAT SYSTEM STATUS MESSAGE
1.3.2.2
DISTRIBUTE MESSAGE TO OTHER PRO-CESSORS
1.3.2.3


DATA BASE BACKUP MANAGEMENT 1.3.3
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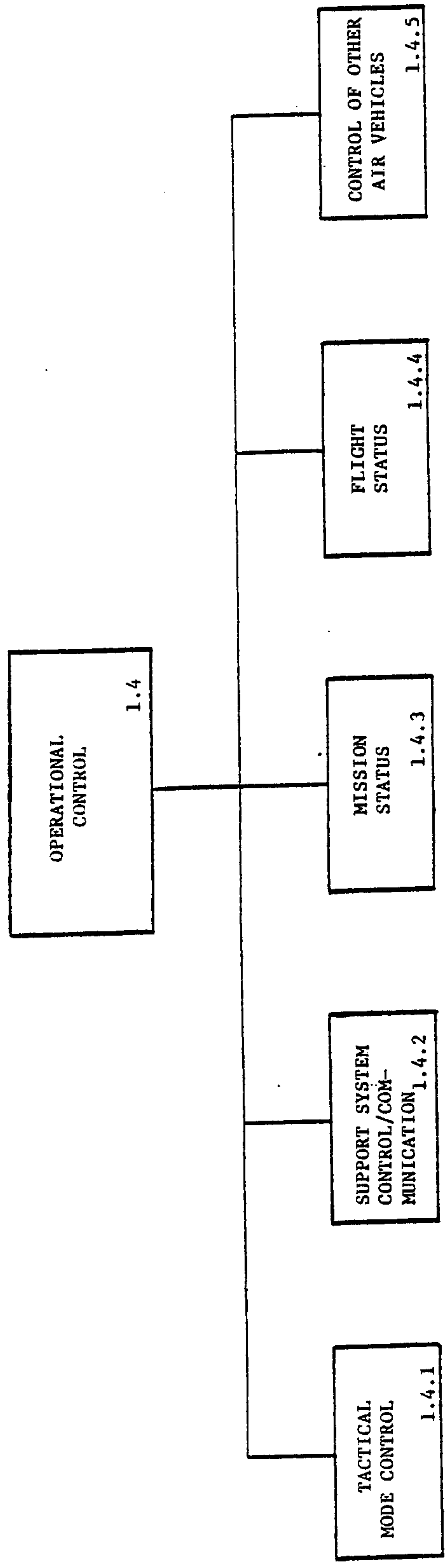
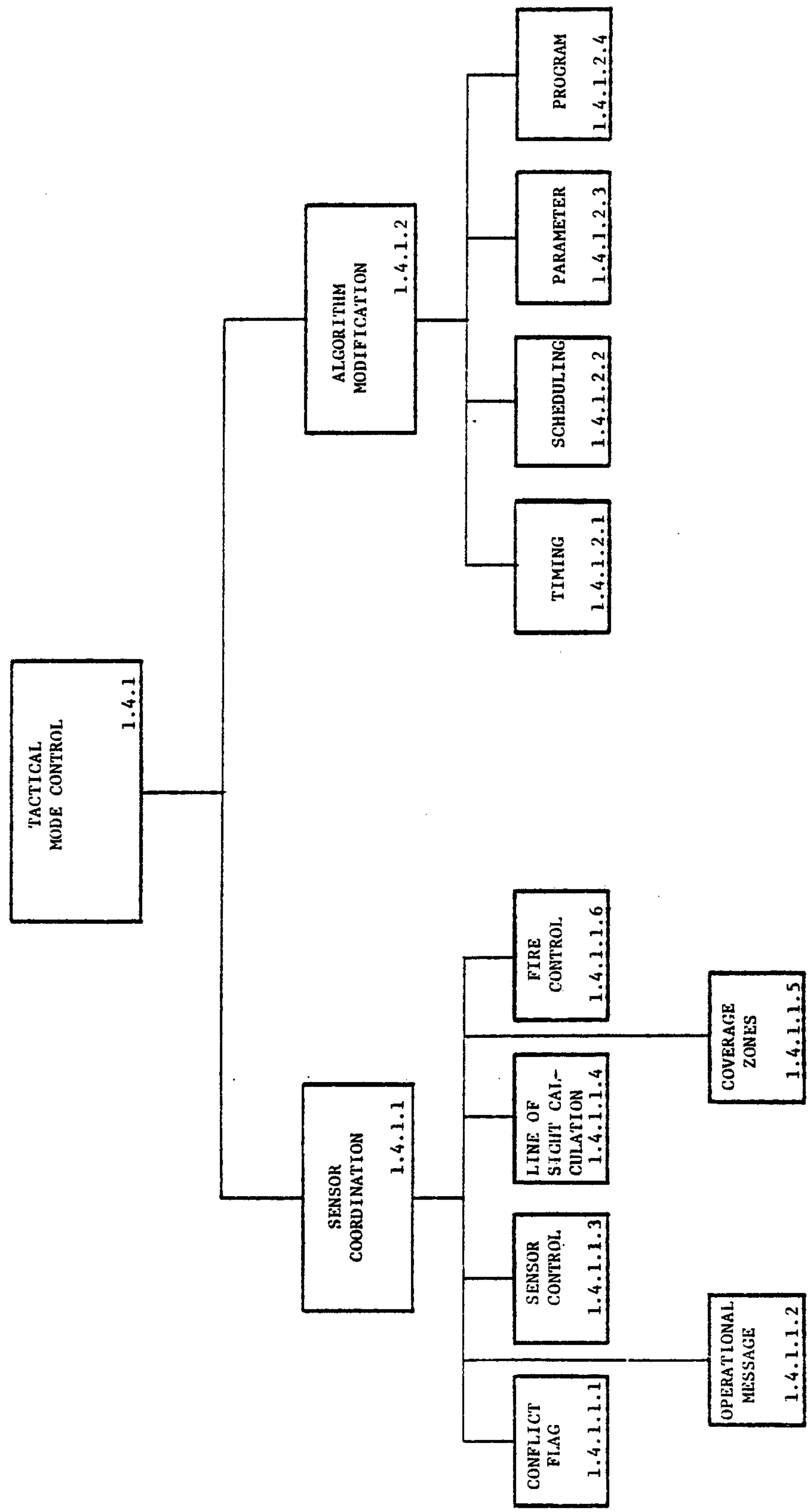
ENGINE STATUS MONITOR 1.3.5
ENGINE STATUS 1.3.5.1
FUEL STATUS 1.3.5.2
FLIGHT ENVELOPE MONITOR 1.3.5.3



OPERATIONAL CONTROL
1.4
TACTICAL MODE CONTROL
1.4.1
SUPPORT SYSTEM CONTROL/COM-MUNICATION
1.4.2
MISSION STATUS
1.4.3
FLIGHT STATUS
1.4.4
CONTROL OF OTHER AIR VEHICLES
1.4.5


TACTICAL MODE CONTROL
1.4.1
SENSOR COORDINATION
1.4.1.1
ALGORITHM MODIFICATION
1.4.1.2
CONFLICT FLAG
1.4.1.1.1
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1.4.1.1.2
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1.4.1.1.3
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1.4.1.1.5
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1.4.1.1.6
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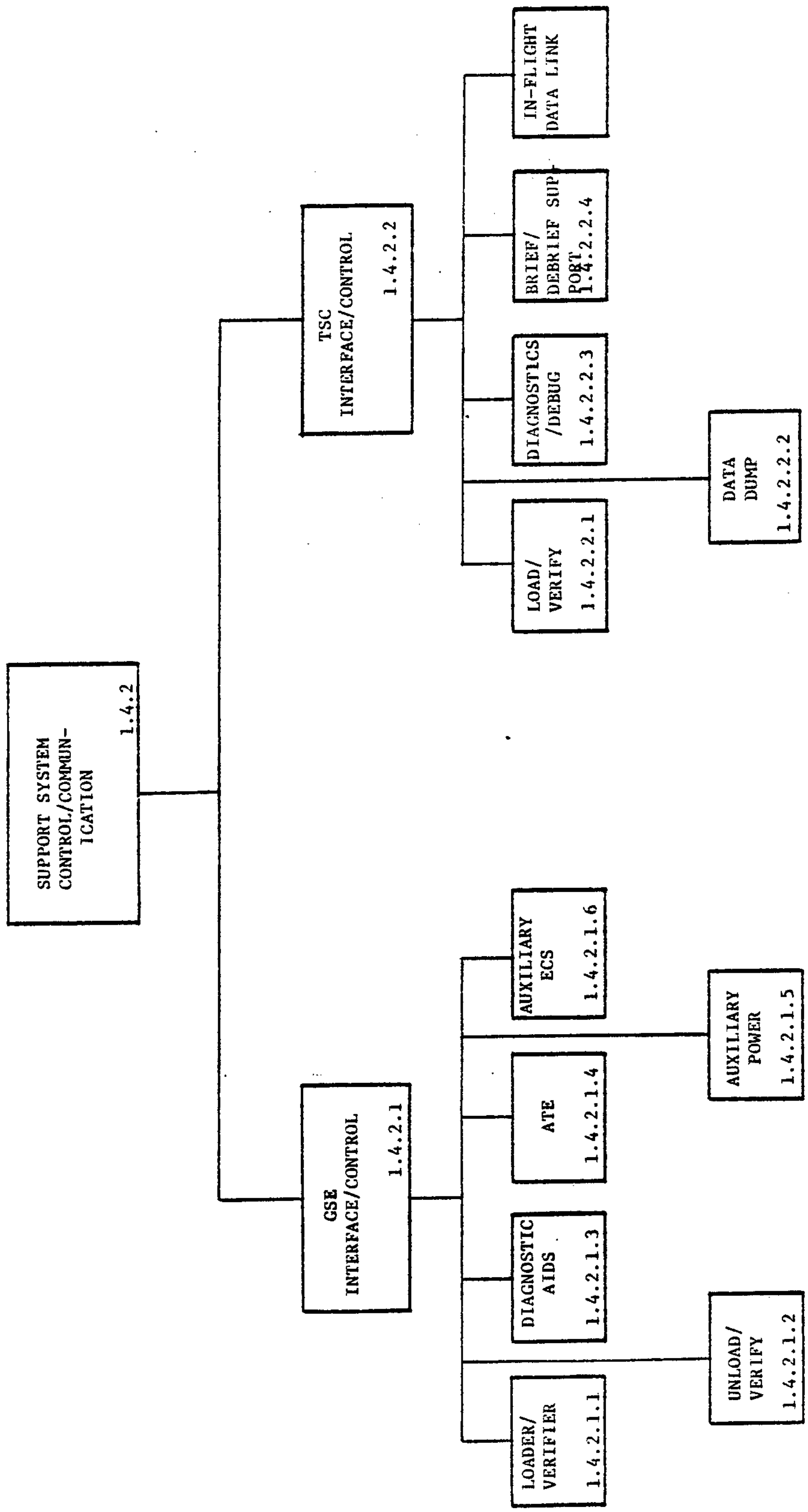
1.4.1.2.1
SCHEDULING
1.4.1.2.2
PARAMETER
1.4.1.2.3
PROGRAM
1.4.1.2.4


SUPPORT SYSTEM CONTROL/COMMUNICATION 1.4.2
GSE INTERFACE/CONTROL 1.4.2.1
LOADER/ VERIFIER 1.4.2.1.1
UNLOAD/ VERIFY 1.4.2.1.2
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ATE 1.4.2.1.4
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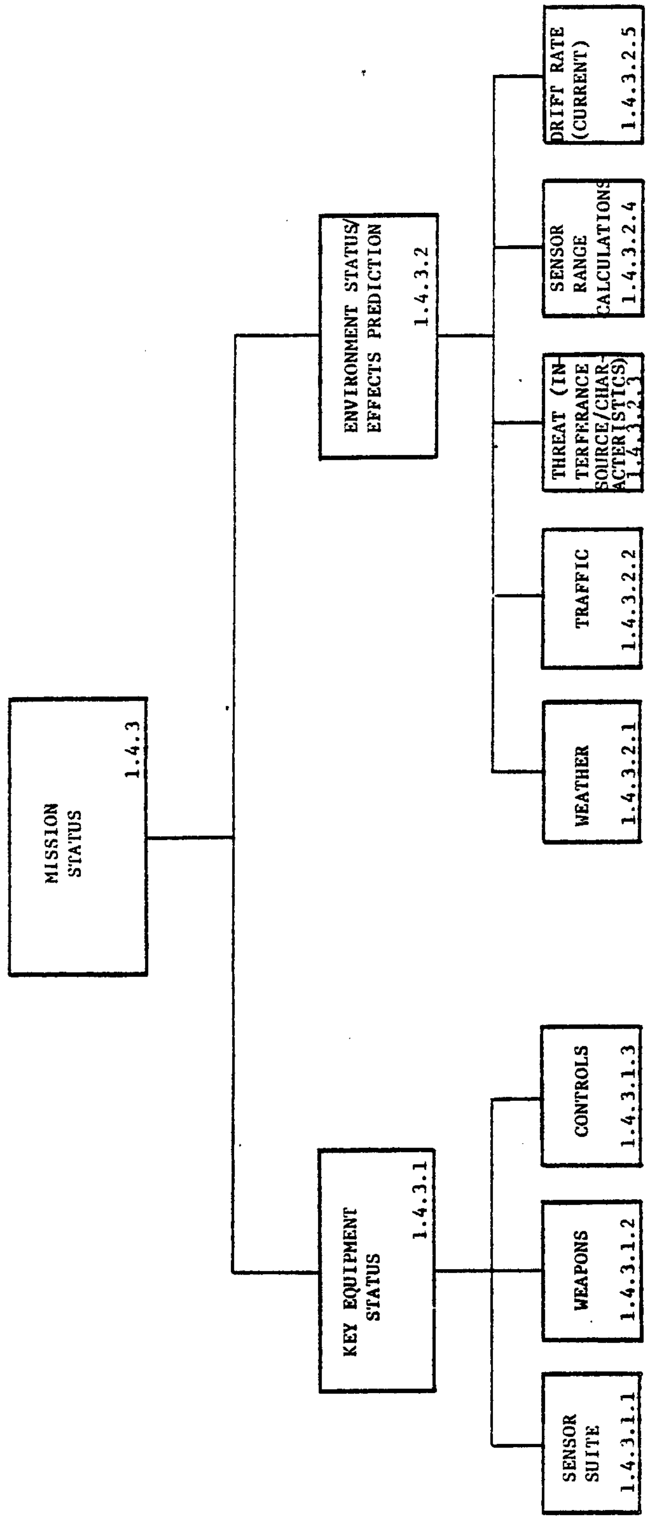
DATA DUMP 1.4.2.2.2
DIAGNOSTICS /DEBUG 1.4.2.2.3
BRIEF/ DEBRIEF SUPPORT 1.4.2.2.4
IN-FLIGHT DATA LINK


MISSION STATUS
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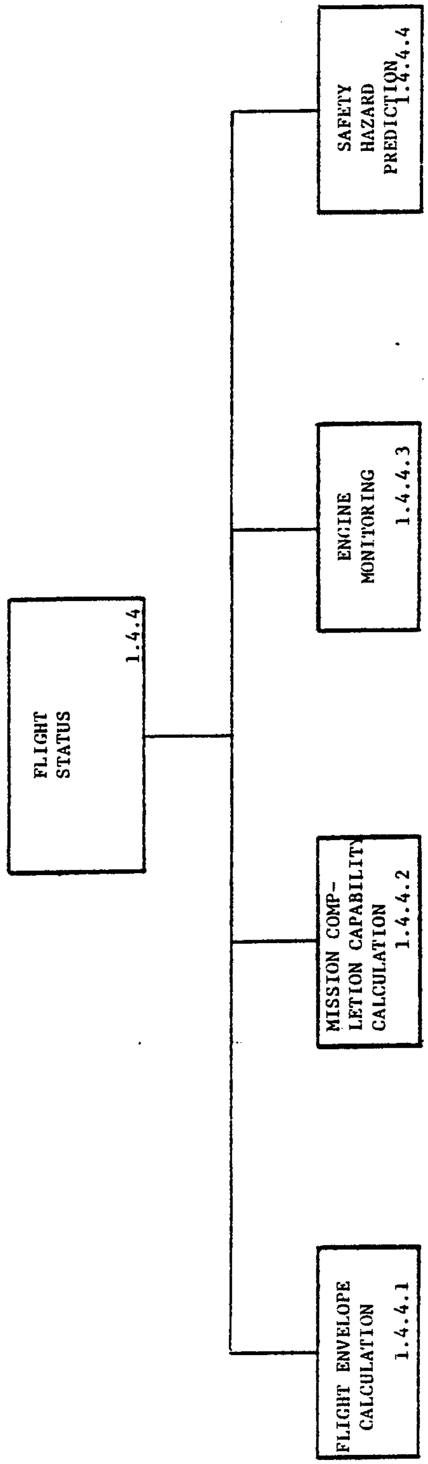
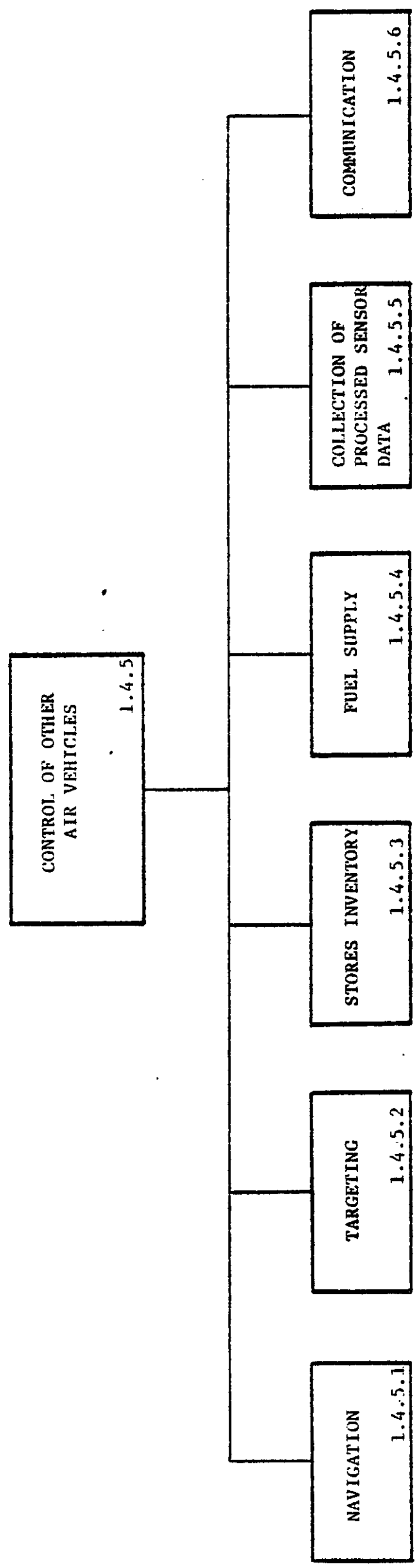
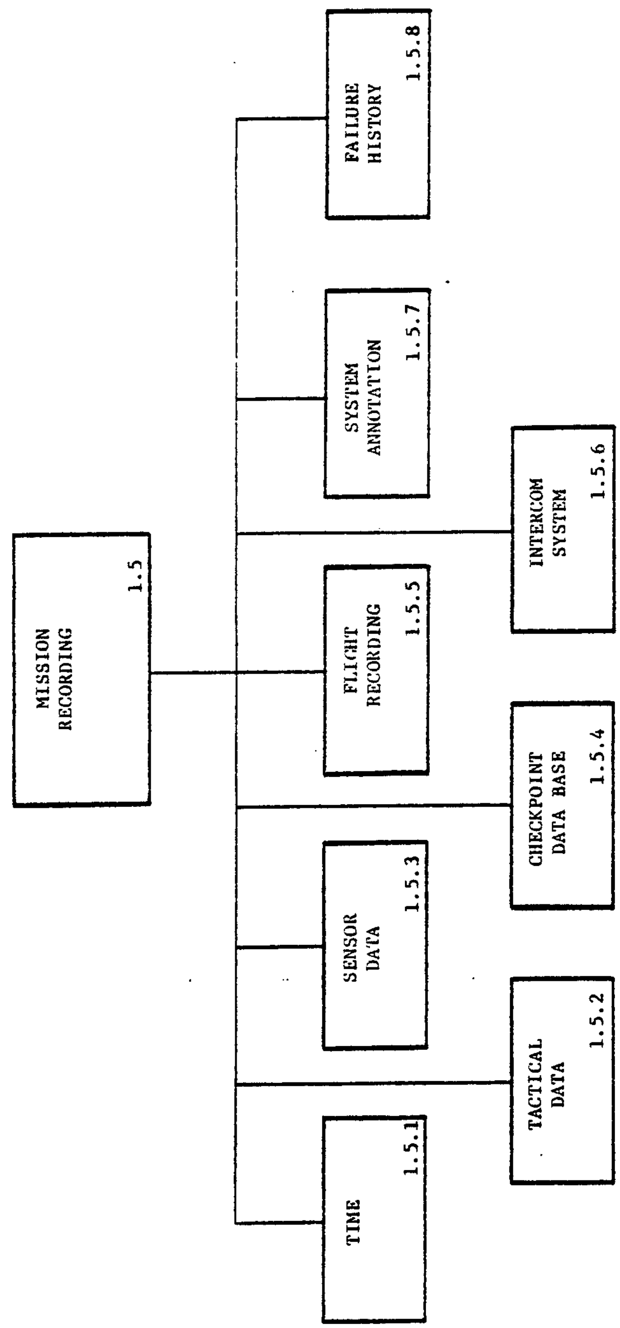
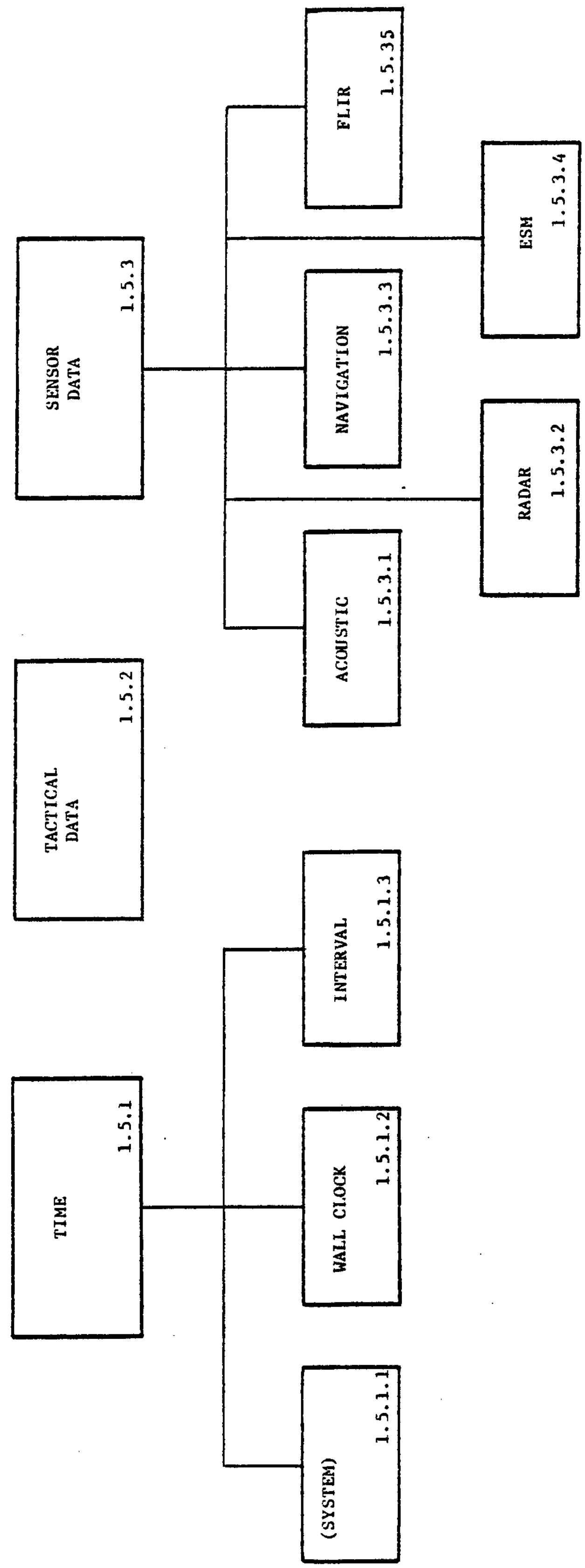
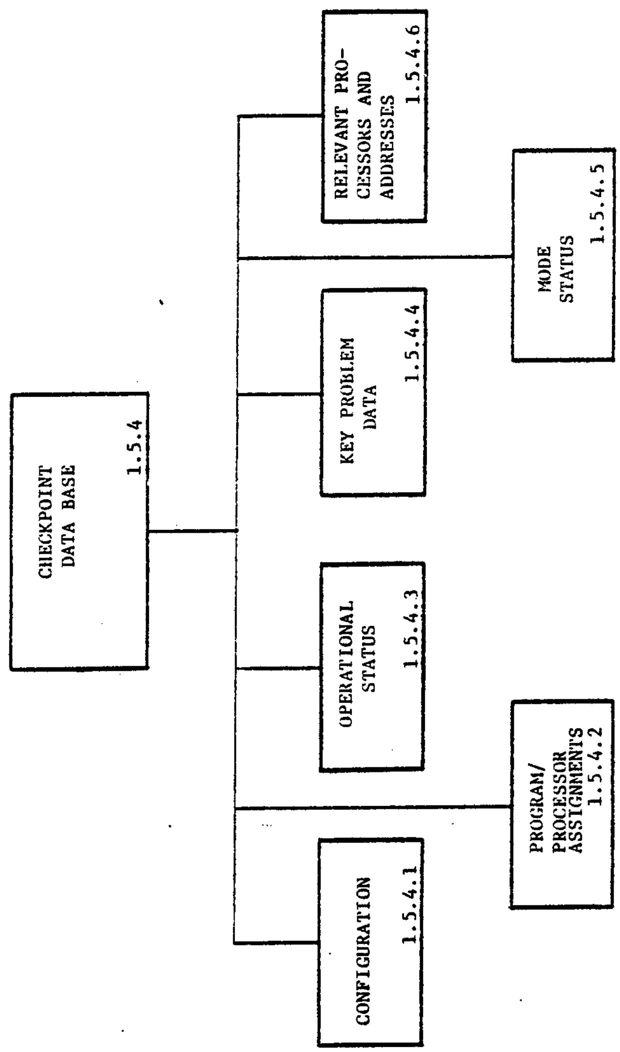
KEY EQUIPMENT STATUS
1.4.3.1
SENSOR SUITE
1.4.3.1.1
WEAPONS
1.4.3.1.2
CONTROLS
1.4.3.1.3
ENVIRONMENT STATUS/ EFFECTS PREDICTION
1.4.3.2
WEATHER
1.4.3.2.1
TRAFFIC
1.4.3.2.2
THREAT (INTERFERANCE SOURCE/CHARACTERISTICS)
1.4.3.2.3
SENSOR RANGE CALCULATIONS
1.4.3.2.4
DRIFT RATE (CURRENT)
1.4.3.2.5

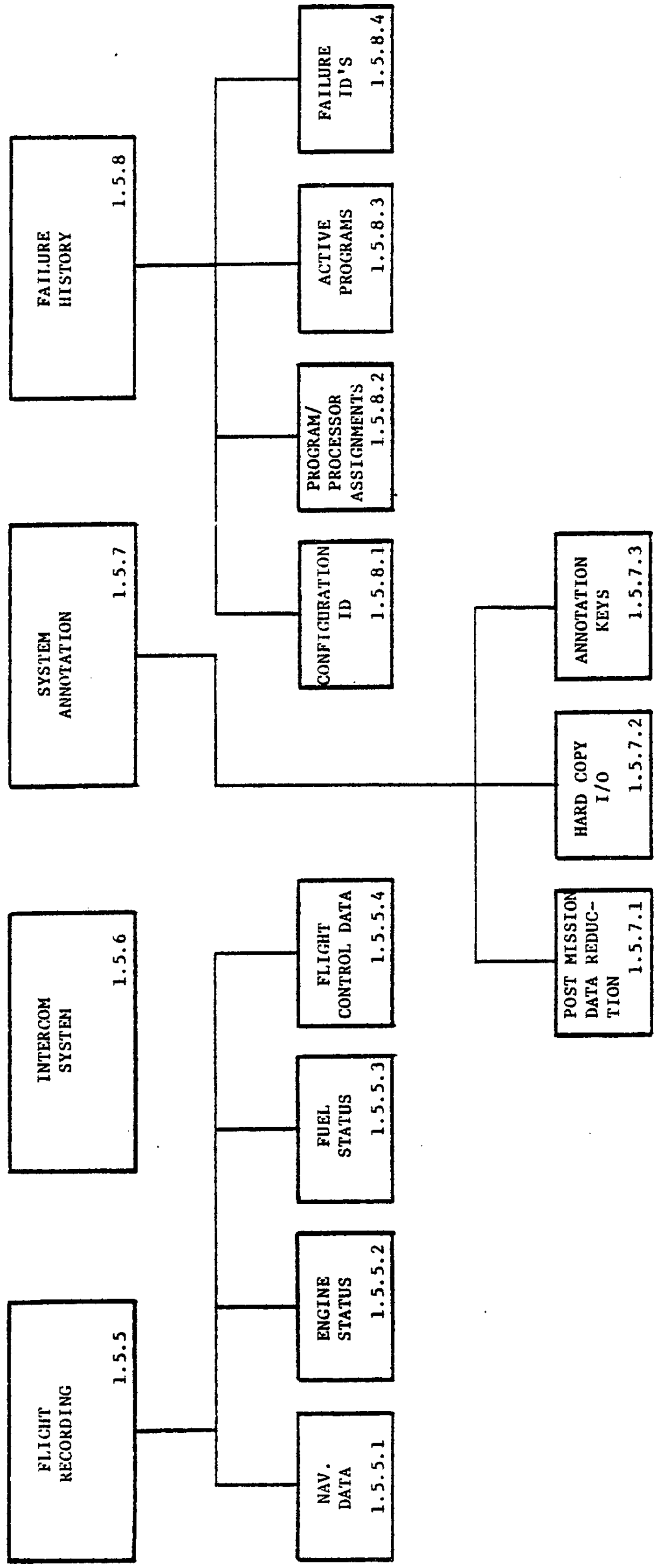

FLIGHT STATUS
1.4.4
FLIGHT ENVELOPE CALCULATION
1.4.4.1
MISSION COMP-LETION CAPABILITY CALCULATION
1.4.4.2
ENGINE MONITORING
1.4.4.3
SAFETY HAZARD PREDICTION
1.4.4.4


CONTROL OF OTHER AIR VEHICLES 1.4.5
NAVIGATION 1.4.5.1
TARGETING 1.4.5.2
STORES INVENTORY 1.4.5.3
FUEL SUPPLY 1.4.5.4
COLLECTION OF PROCESSED SENSOR DATA 1.4.5.5
COMMUNICATION 1.4.5.6


MISSION RECORDING 1.5
TIME 1.5.1
TACTICAL DATA 1.5.2
SENSOR DATA 1.5.3
CHECKPOINT DATA BASE 1.5.4
FLIGHT RECORDING 1.5.5
INTERCOM SYSTEM 1.5.6
SYSTEM ANNOTATION 1.5.7
FAILURE HISTORY 1.5.8


TIME
1.5.1
(SYSTEM)
1.5.1.1
WALL CLOCK
1.5.1.2
INTERVAL
1.5.1.3
TACTICAL
DATA
1.5.2
SENSOR
DATA
1.5.3
ACOUSTIC
1.5.3.1
RADAR
1.5.3.2
NAVIGATION
1.5.3.3
ESM
1.5.3.4
FLIR
1.5.35


CHECKPOINT DATA BASE 1.5.4
CONFIGURATION 1.5.4.1
PROGRAM/ PROCESSOR ASSIGNMENTS 1.5.4.2
OPERATIONAL STATUS 1.5.4.3
KEY PROBLEM DATA 1.5.4.4
MODE STATUS 1.5.4.5
RELEVANT PRO- CESSORS AND ADDRESSES 1.5.4.6


FLIGHT RECORDING 1.5.5
NAV. DATA 1.5.5.1
ENGINE STATUS 1.5.5.2
FUEL STATUS 1.5.5.3
FLIGHT CONTROL DATA 1.5.5.4
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SYSTEM ANNOTATION 1.5.7
POST MISSION DATA REDUC-TION 1.5.7.1
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CONFIGURATION ID 1.5.8.1
PROGRAM/ PROCESSOR ASSIGNMENTS 1.5.8.2
ACTIVE PROGRAMS 1.5.8.3
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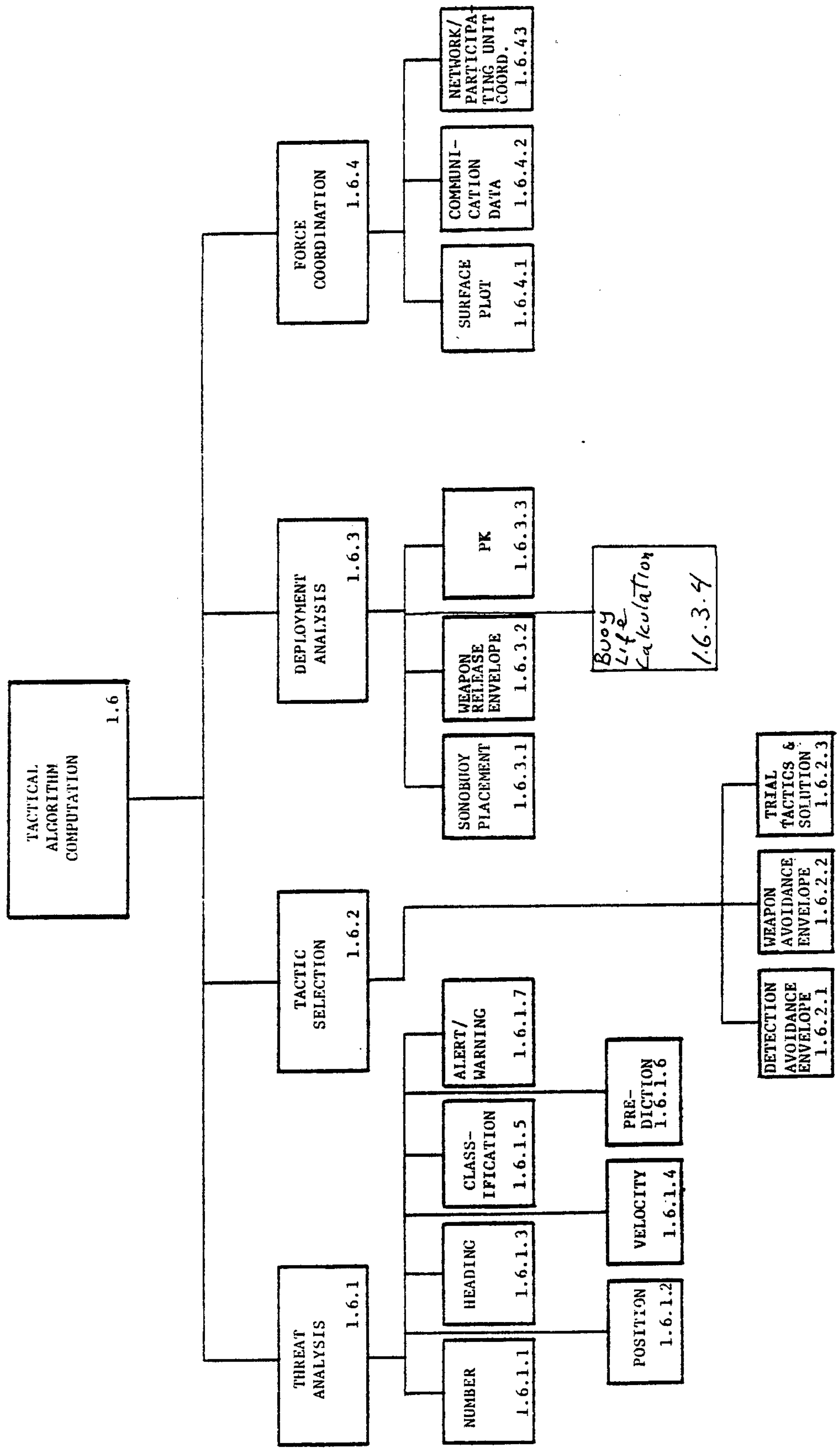
TACTICAL ALGORITHM COMPUTATION 1.6
THREAT ANALYSIS 1.6.1
TACTIC SELECTION 1.6.2
DEPLOYMENT ANALYSIS 1.6.3
FORCE COORDINATION 1.6.4
NUMBER 1.6.1.1
POSITION 1.6.1.2
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VELOCITY 1.6.1.4
CLASS-IFICATION 1.6.1.5
PRE-DICTION 1.6.1.6
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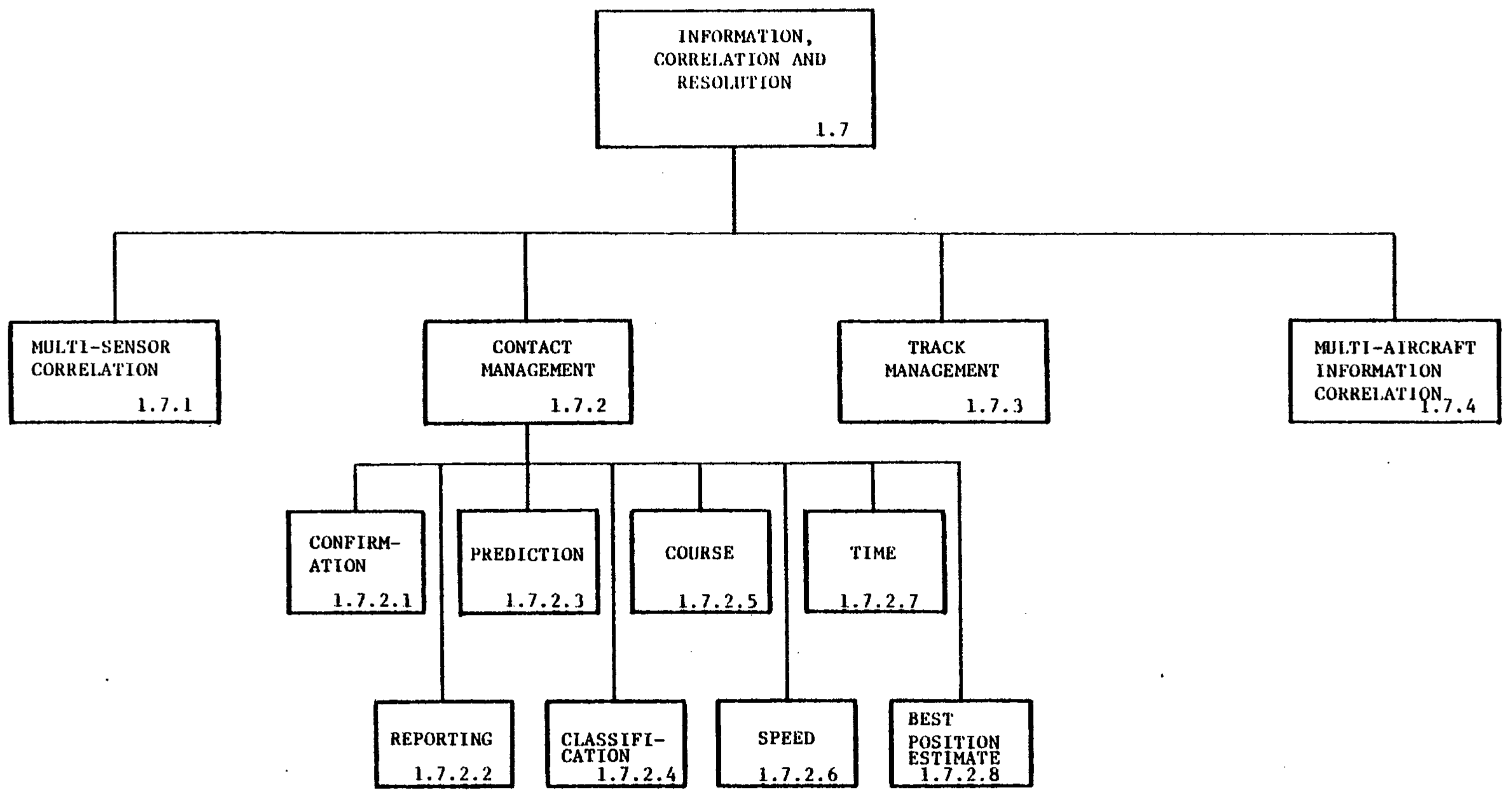
SONOBUOY PLACEMENT 1.6.3.1
WEAPON RELEASE ENVELOPE 1.6.3.2
PK 1.6.3.3
Buoy Life Calculation 1.6.3.4
SURFACE PLOT 1.6.4.1
COMMUNI-CATION DATA 1.6.4.2
NETWORK/PARTICIPATING UNIT COORD. 1.6.43



INFORMATION, CORRELATION AND RESOLUTION 1.7
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CONTACT MANAGEMENT 1.7.2
TRACK MANAGEMENT 1.7.3
MULTI-AIRCRAFT INFORMATION CORRELATION 1.7.4
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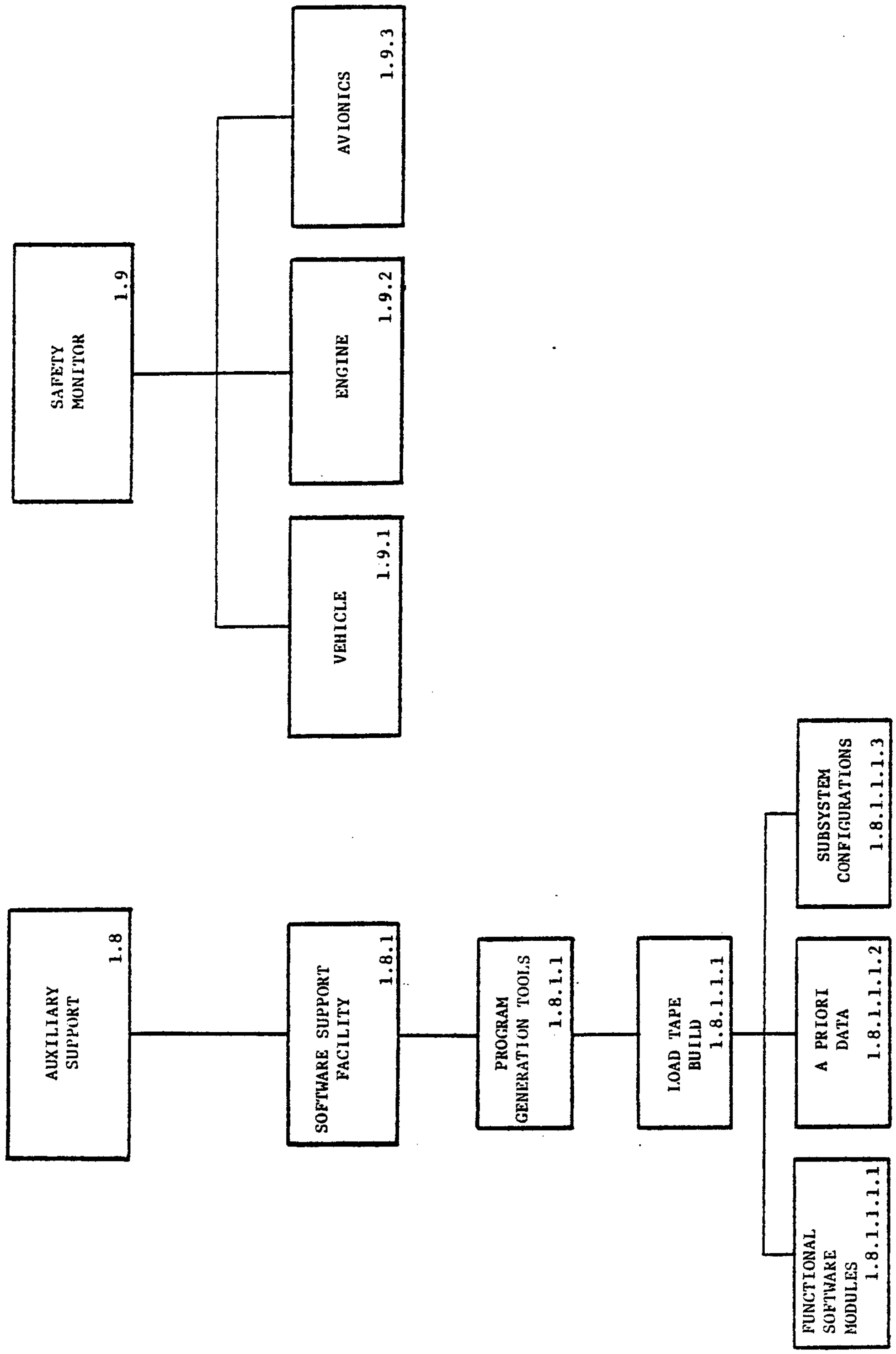
REPORTING 1.7.2.2
PREDICTION 1.7.2.3
CLASSIFI-CATION 1.7.2.4
COURSE 1.7.2.5
SPEED 1.7.2.6
TIME 1.7.2.7
BEST POSITION ESTIMATE 1.7.2.8


SAFETY MONITOR 1.9
VEHICLE 1.9.1
ENGINE 1.9.2
AVIONICS 1.9.3
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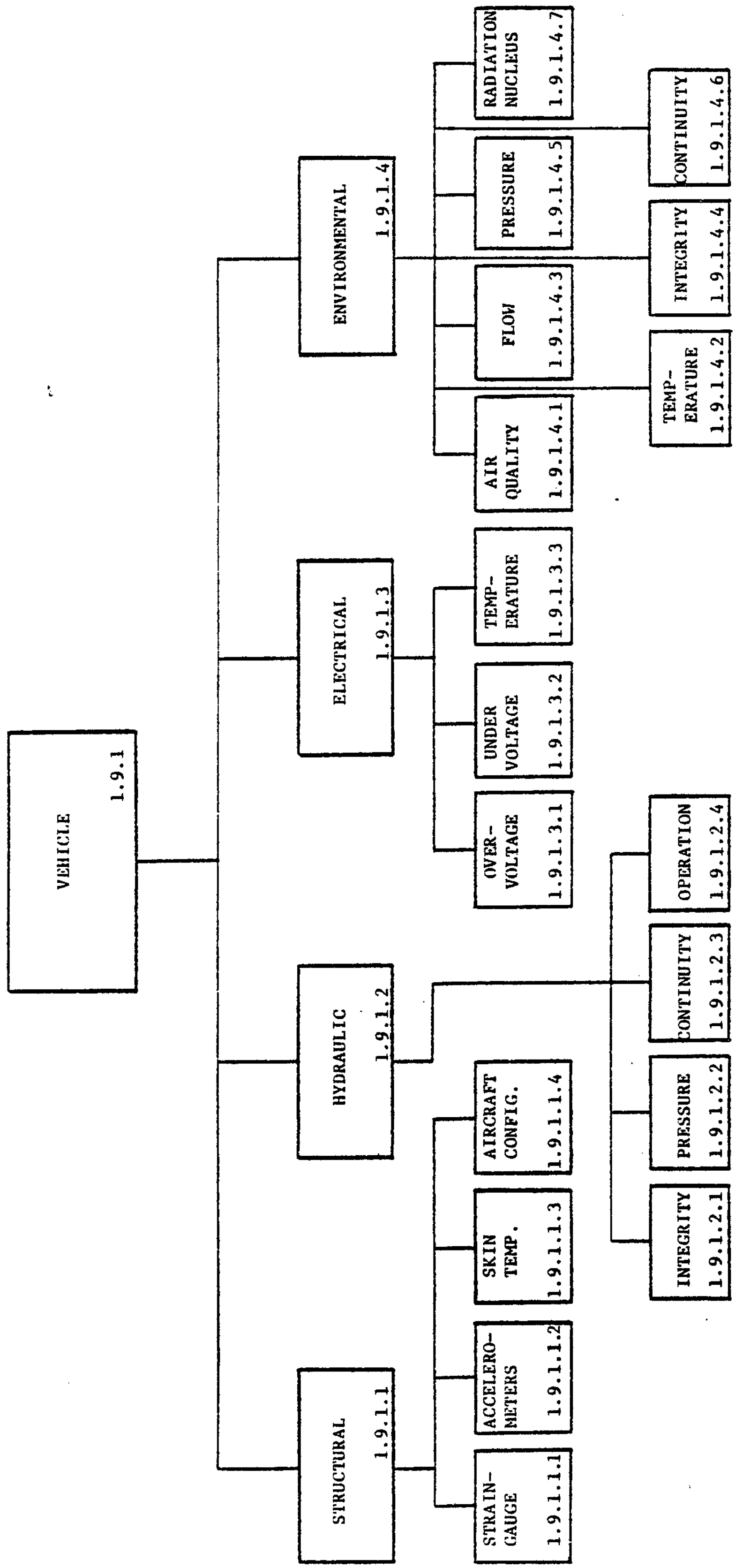
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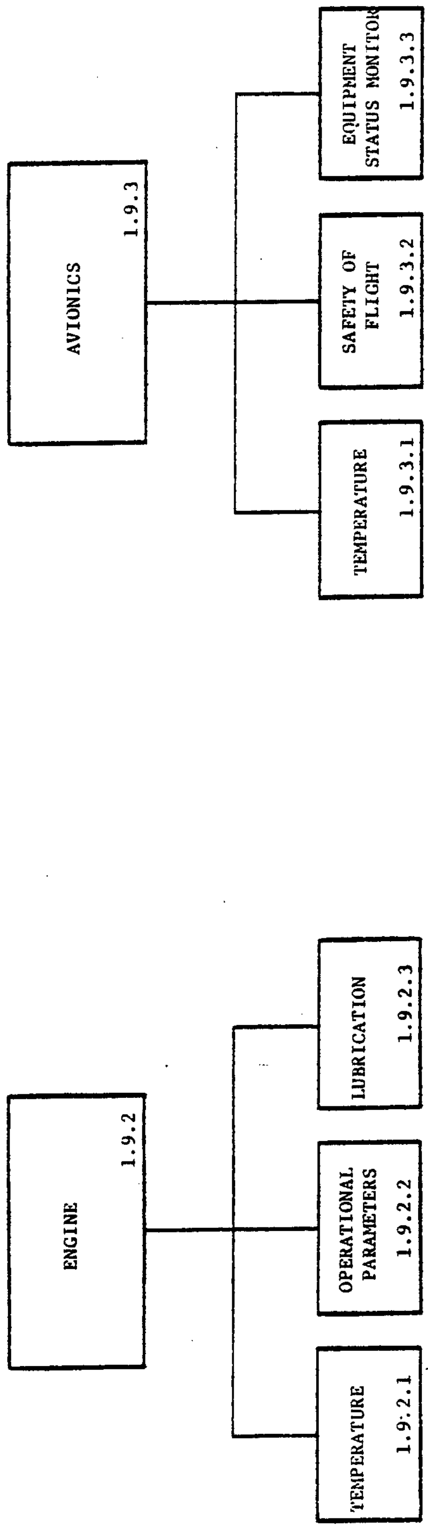
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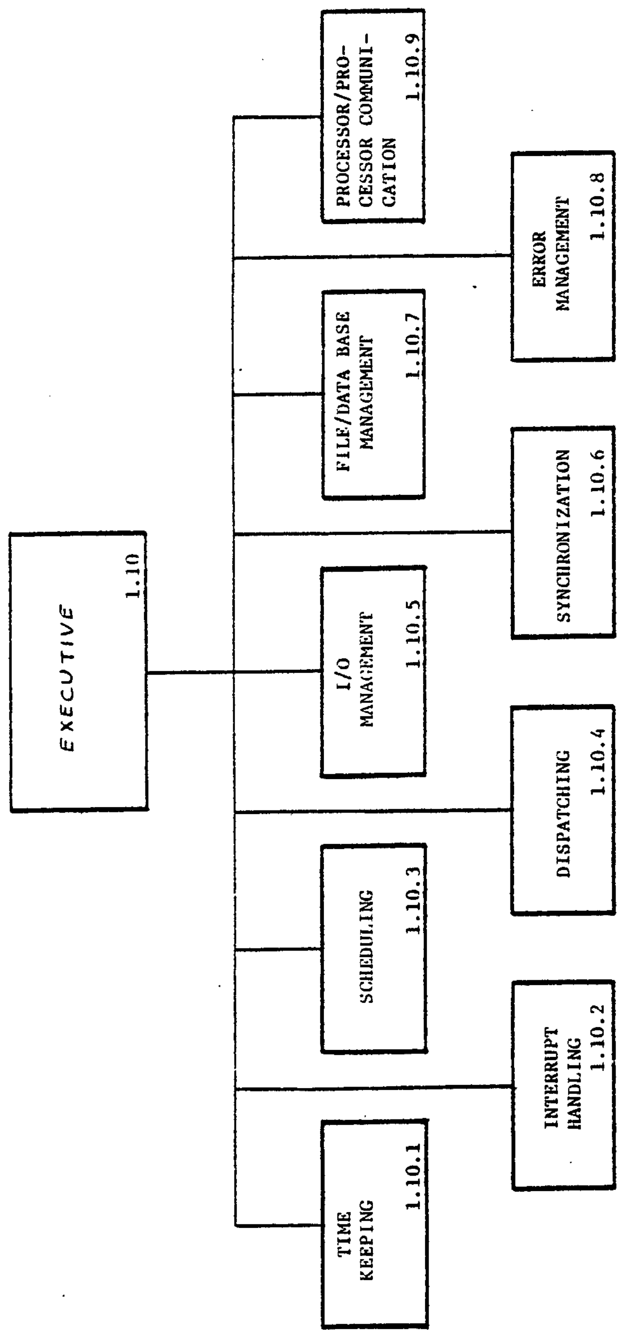
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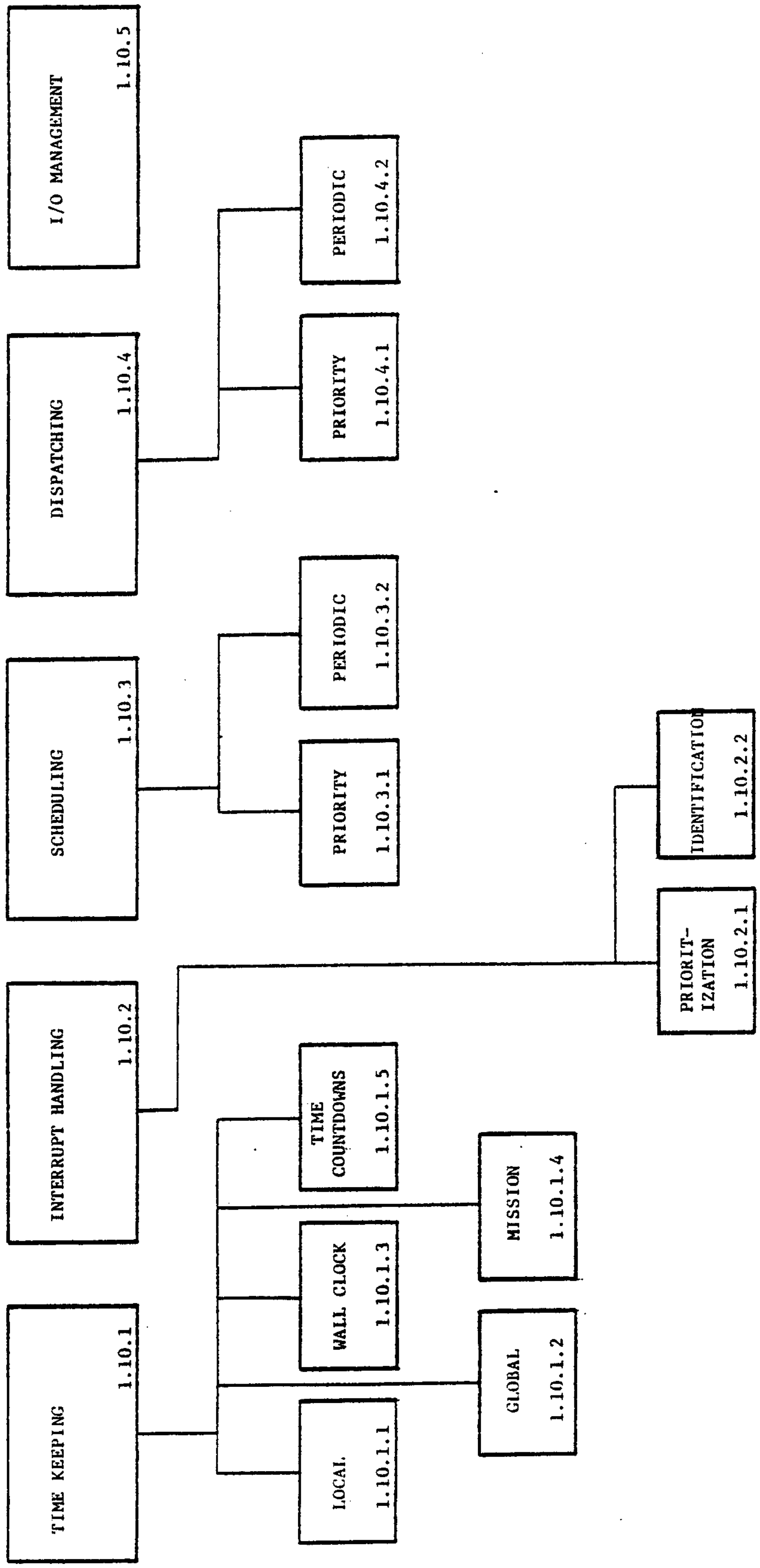
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DISPATCHING
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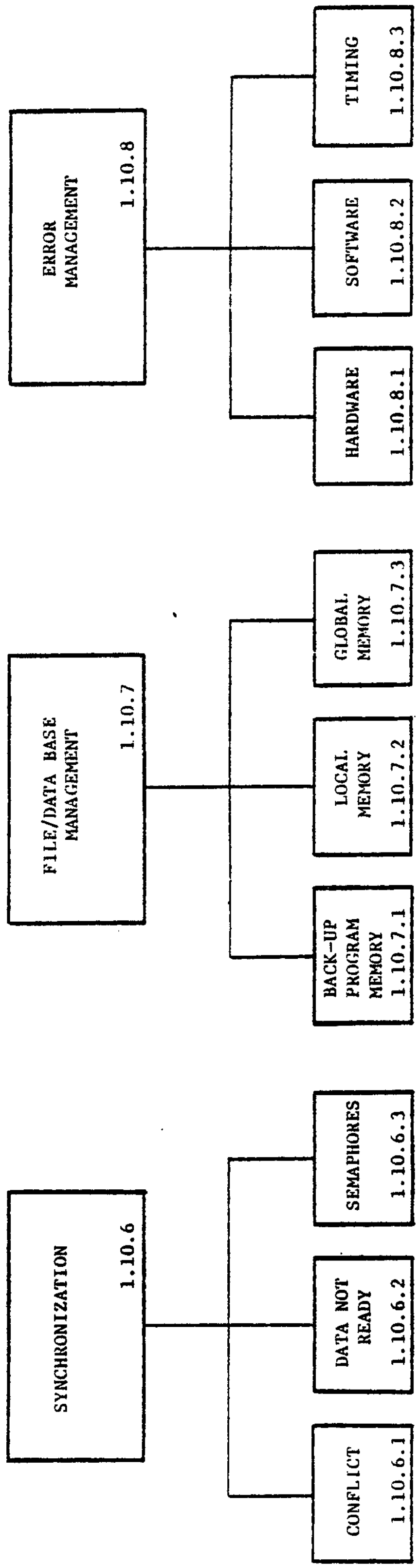
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CONFLICT
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1.10.8
HARDWARE
1.10.8.1
SOFTWARE
1.10.8.2
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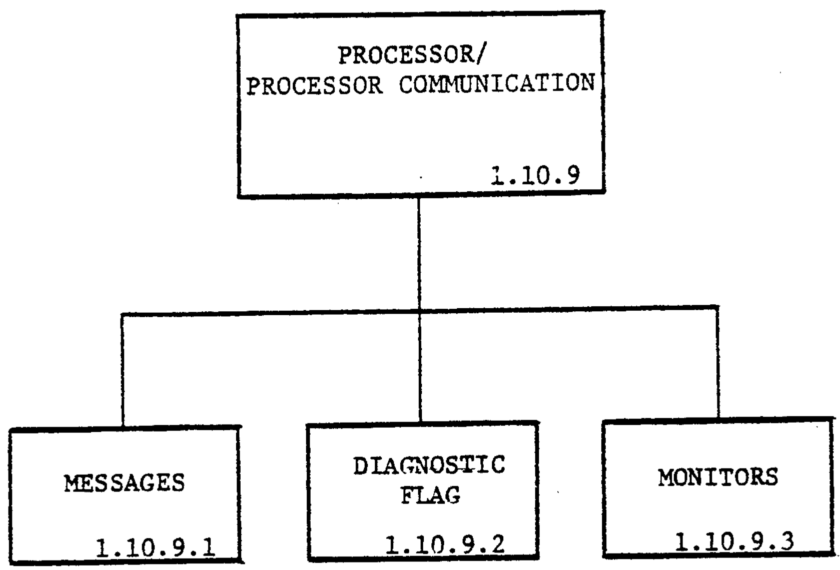
1.10.8.3


PROCESSOR/
PROCESSOR COMMUNICATION
1.10.9
MESSAGES
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DIAGNOSTIC
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2.0 SYSTEM DISPLAY AND DISPLAY CONTROL

Functional Description - The display subsystem aboard the V/STOL aircraft has the function of visually presenting to the crew: mission system data, flight information, tactical information, sensor information and status alerts. V/STOL subsystems can transfer data directly to the display subsystem only after the data transferring subsystem has obtained authorization from the V/STOL system controller. The system controller can also withdraw this authorization, at which time the subsystem will no longer be able to communicate with the display, to permit different subsystems which have higher priority information to transfer that information.

An integrated display will be placed at each V/STOL crew station, and the display will have the capability of generating alphanumerics, conics, cursors, symbols and graphics. The operator will be able to select which data that he wishes to display, though the format of data display will not be changeable by the operator.

Inputs - Mission information received from the system controller, subsystem processors and operators; and display commands received from the operators and system controller.

Outputs - Display of sensor, tactical and flight information.

2.1 DISPLAY OF SYSTEM DATA

Functional Description - The results of all system and subsystem readiness and diagnostic tests are transferred from the system controller to the display during pre-flight, where the data can be viewed as tableaus. The tableaus will show the status of all subsystems, and will also show any fault call-outs along with the corresponding page or subunit identification that needs to be changed. After launch of the V/STOL, a tableau will be maintained which shows the status of in-flight performance monitoring (IFPM). This tableau can be selected for display by an operator, or the system will periodically display it. The system controller can set a flashing display format, for those conditions that the operator should be alerted to, such as a subsystem failing an IFPM test.

A display will be available to the operator to show the configuration of each subsystem (such as the operating mode of a processor), and the availability of all V/STOL stores including weapons. Apriori data that was loaded as part of the system initialization can also be viewed by the operator.

Certain sets of data that are displayed can be modified by the operator by changing the tableau via the keyset. The tableau will indicate which data is operator modifiable and the system will respond to this data modification by changing the data in the system CPU memory. As an example, the operator may find certain stores to be defective, hence he would want to change the available stores inventory tableau; or he may update the apriori information with more current observations.

Inputs - System data received from system controller.

Outputs - Visual display of test results, system readiness, configuration data and mission event summary.

2.2 DISPLAY OF OPERATIONAL DATA

Functional Description - The system controller will maintain an integrated operational mission display which will superimpose V/STOL flight information (i.e., location, speed and altitude) on the mission tactical display. The display will indicate all sensor contacts along with classification and computed track of each target. Target weapon avoidance envelopes will also be shown for all detected targets, along with the range envelope where the V/STOL weapons would be effective against the target. The operator will have the option to select the amount of information to display which will satisfy the requirements for either more detailed information (i.e., individual sensor measurements) or a need to reduce the clutter of data on the display (i.e., display only hostile targets). Apriori data relative to the location of undetected hostile targets can also be displayed, along with preflight briefed information on the deployment of friendly forces.. An alert (flashing display) would be indicated by the system whenever the V/STOL aircraft came within the weapon avoidance envelope on a hostile target.

Inputs - Mission data received from V/STOL subsystems.

Outputs - Display of sensor, tactical and flight information.

2.3 DISPLAY OF STATUS ALERTS

Functional Description - There are many conditions that may arise during the course of a mission that require immediate operator/pilot action. These conditions are detected by the system controller, either through the direct transmission of an alert from a subsystem or based upon computations made within the system controller. The alert is immediately displayed as flashing alphanumerics on all crew station display units. The alert condition will be maintained by the system controller until crew action is taken to clear it. The alerts can fall into any one of the following categories:

a. Flight Safety - This concerns hazardous conditions involving vehicle, engine and avionics systems which affect safety of flight.

b. Tactical - Whenever the system controller (based upon inputs from the navigation and sensor subsystems) computes that the V/STOL aircraft has either entered a hostile area or is currently within the weapon range of a hostile target, the controller will direct the display system to show a tactical alert. This alert will be maintained by the system until either cleared by the operator, or the V/STOL aircraft's relative position changes enough to move it out of the tactical alert area.

c. Operational Status - This class of alerts indicates either a subsystem failure, a configuration incompatibility between two or more subsystems, or a mission required operator action that has not yet taken place. The operator can clear the subsystem failure alert either by just acknowledging it or by reconfiguring another operating subsystem to function in place of the one that failed. A subsystem configuration incompatibility must be cleared by the operator directing the system controller to reconfigure one or more of the subsystems. All alerts due to the failure of an operator to perform a required action are maintained by the system controller until the required operator action is taken.

Inputs - Warning conditions generated by V/STOL subsystems.

Outputs - A display of a condition that requires immediate operator/pilot action.

2.4 DISPLAY AND CONTROL MANAGEMENT

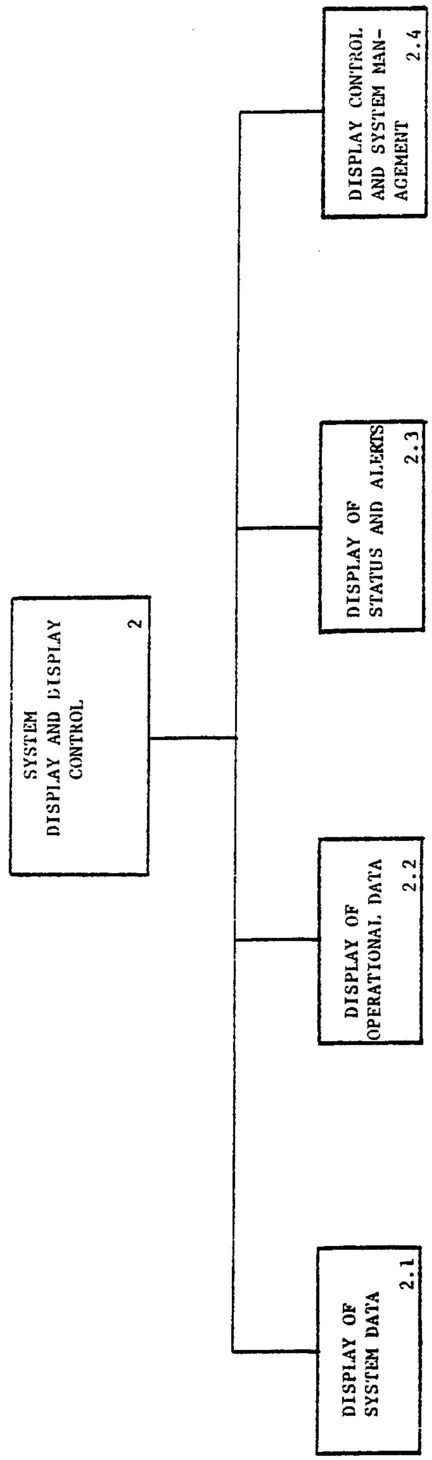
Functional Description - The display subsystem is initialized by the system controller, which includes running a hardware diagnostic program with the display subsystem reporting back a go or no go condition. A no go report will cause the display subsystem to be shut down. Following successful execution of the diagnostic program the system controller will load the display with operational software and configuration data and the display will report back to the controller the successful loading of this software. During the mission, the system controller will periodically collect recovery data from the display subsystem. This data will be used to reinitialize the subsystem should it fail during the mission.

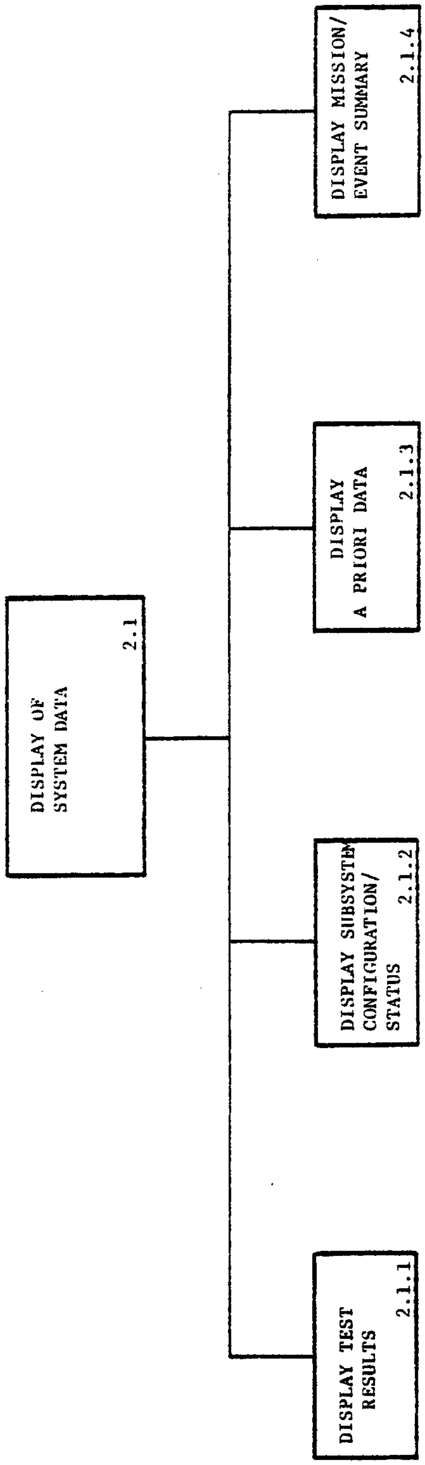
The display subsystem data will be managed in such a way as to support all displays that can be requested by the system controller. It must be able to fetch the data associated with the requested display from the display storage medium, and it must also be prepared to modify stored data as requested by either the system controller or the operator via a keyset display modification.

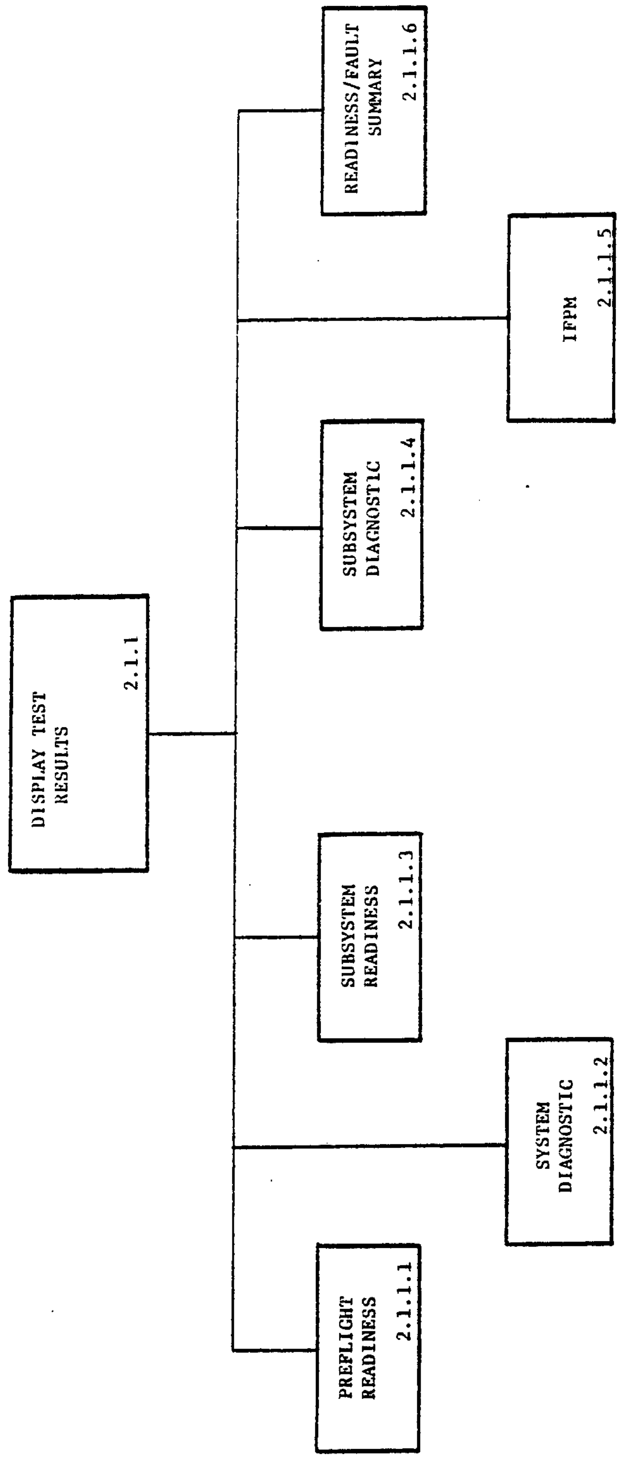
The display subsystem will be able to generate alphanumerics, symbols, conics, cursors, and graphics which will be programmed for in support of each of the required displays; and optimum scan and refresh rates will be determined and preset into the subsystem (the system controller will not have any control over the scan and refresh rate). Single and multiple information sets can be displayed in support of sensor data, tactical plots, navigation plots, maps and tableaus. The operator will have freedom to select any available display format at any time, with the exception that the system controller will preempt any display whenever an alert is detected.

Inputs - Data words from the system controller and subsystems containing information obtained by the various V/STOL subsystems and command words directing the display subsystem to format and display the information.

Outputs - Control of all data received from the system controller and subsystems by the display subsystem.


SYSTEM
DISPLAY AND DISPLAY
CONTROL
2
DISPLAY OF
SYSTEM DATA
2.1
DISPLAY OF
OPERATIONAL DATA
2.2
DISPLAY OF
STATUS AND ALERTS
2.3
DISPLAY CONTROL
AND SYSTEM MAN-
AGEMENT
2.4


DISPLAY OF SYSTEM DATA 2.1
DISPLAY TEST RESULTS 2.1.1
DISPLAY SUBSYSTEM CONFIGURATION/ STATUS 2.1.2
DISPLAY A PRIORI DATA 2.1.3
DISPLAY MISSION/ EVENT SUMMARY 2.1.4


DISPLAY TEST RESULTS
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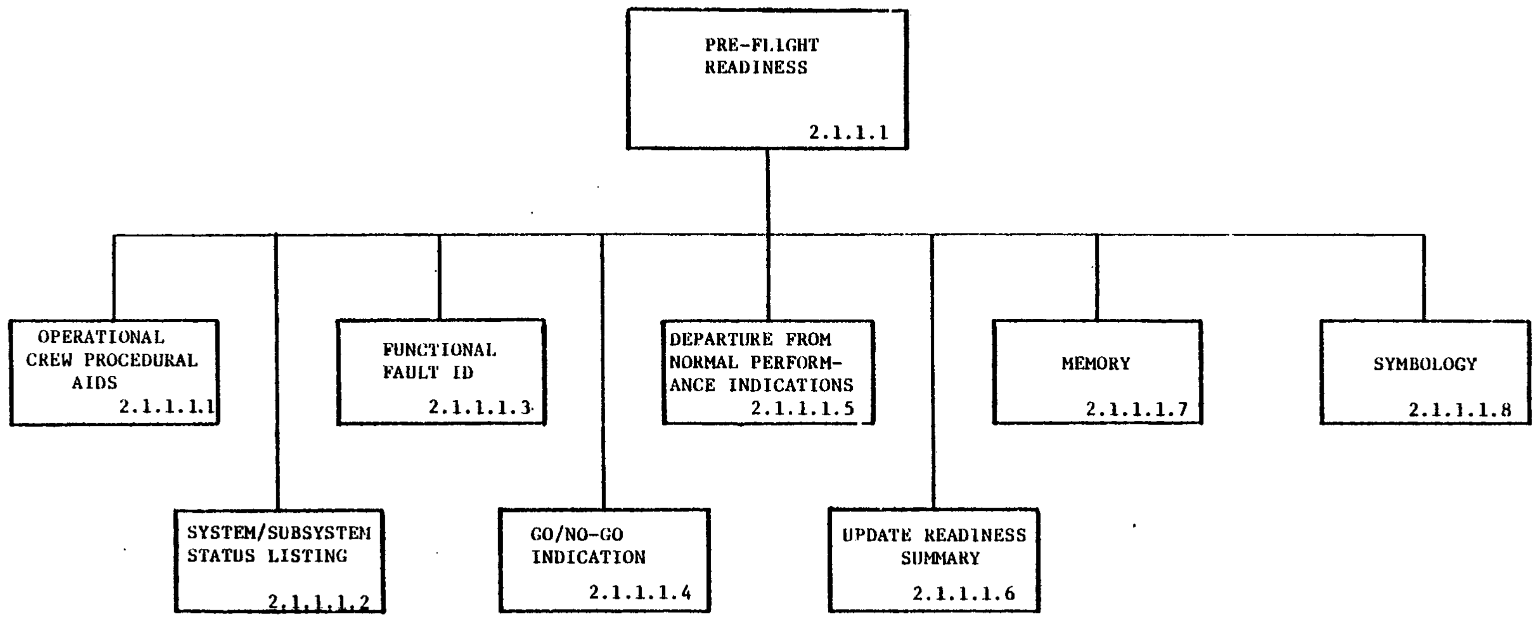
PREFLIGHT READINESS
2.1.1.1
SYSTEM DIAGNOSTIC
2.1.1.2
SUBSYSTEM READINESS
2.1.1.3
SUBSYSTEM DIAGNOSTIC
2.1.1.4
IFPM
2.1.1.5
READINESS/FAULT SUMMARY
2.1.1.6


PRE-FLIGHT READINESS 2.1.1.1
OPERATIONAL CREW PROCEDURAL AIDS 2.1.1.1.1
SYSTEM/SUBSYSTEM STATUS LISTING 2.1.1.1.2
FUNCTIONAL FAULT ID 2.1.1.1.3
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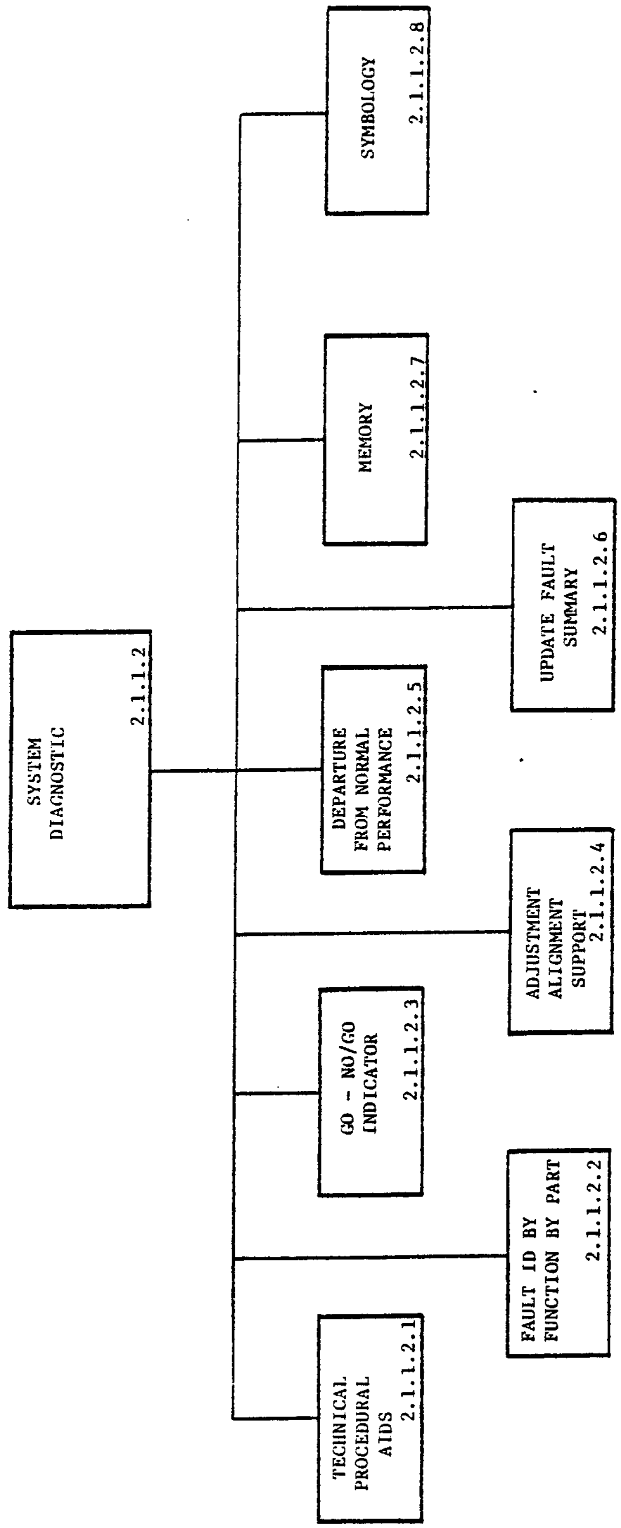
UPDATE READINESS SUMMARY 2.1.1.1.6
MEMORY 2.1.1.1.7
SYMBOLOGY 2.1.1.1.8


SYSTEM DIAGNOSTIC 2.1.1.2
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GO - NO/GO INDICATOR 2.1.1.2.3
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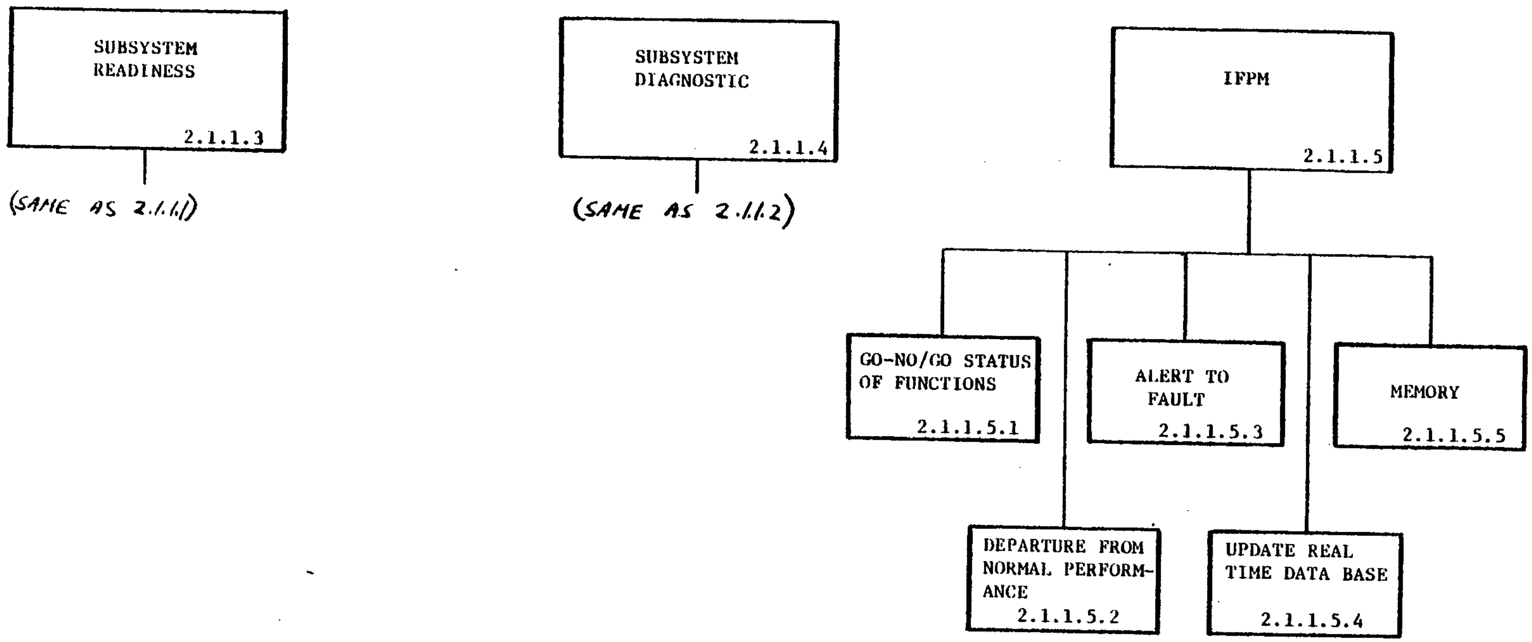
UPDATE FAULT SUMMARY 2.1.1.2.6
MEMORY 2.1.1.2.7
SYMBOLOGY 2.1.1.2.8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SUBSYSTEM DIAGNOSTIC
2.1.1.4
(SAME AS 2.1.1.2)
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2.1.1.5
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2.1.1.5.1
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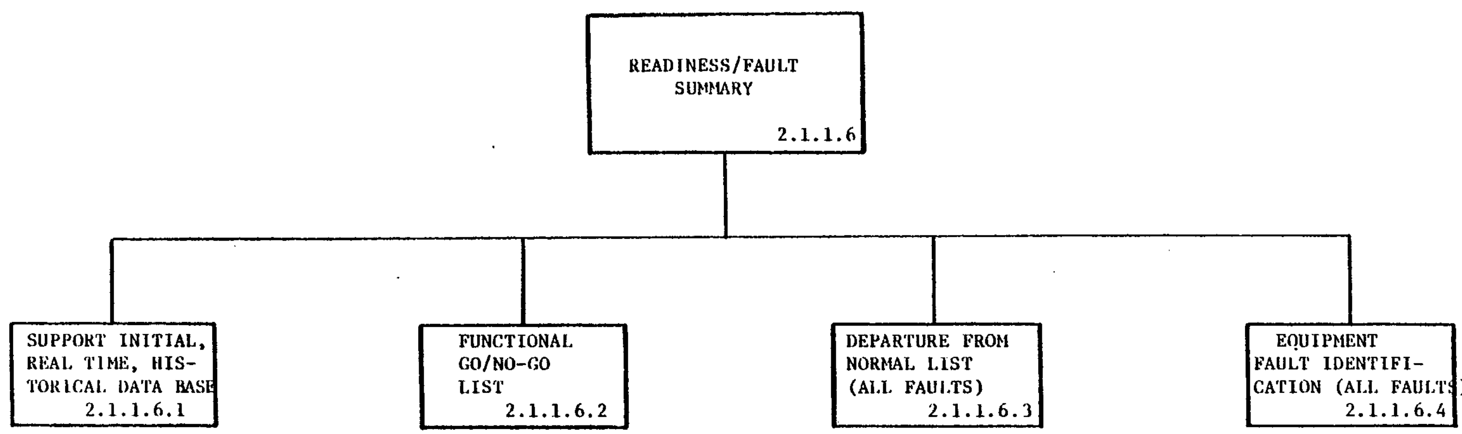
2.1.1.5.2
ALERT TO FAULT
2.1.1.5.3
UPDATE REAL TIME DATA BASE
2.1.1.5.4
MEMORY
2.1.1.5.5


READINESS/FAULT SUMMARY
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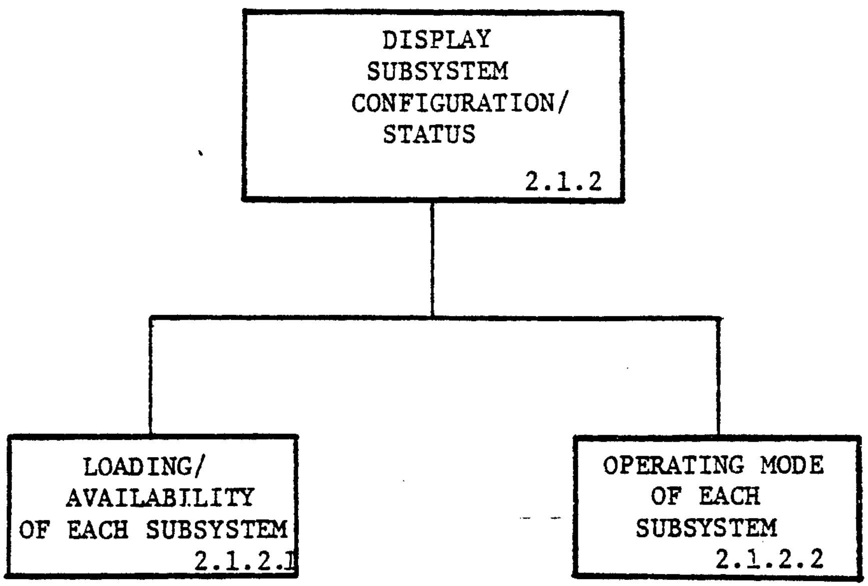
SUPPORT INITIAL, REAL TIME, HISTORICAL DATA BASE
2.1.1.6.1
FUNCTIONAL GO/NO-GO LIST
2.1.1.6.2
DEPARTURE FROM NORMAL LIST (ALL FAULTS)
2.1.1.6.3
EQUIPMENT FAULT IDENTIFICATION (ALL FAULTS)
2.1.1.6.4


DISPLAY SUBSYSTEM CONFIGURATION/ STATUS
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LOADING/ AVAILABILITY OF EACH SUBSYSTEM
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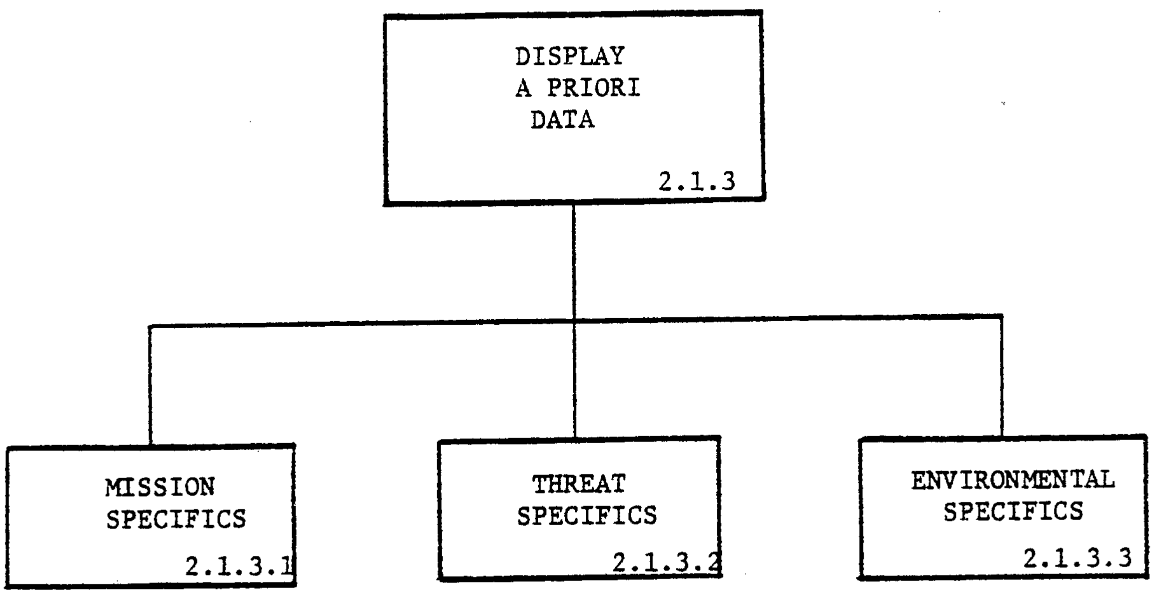
OPERATING MODE OF EACH SUBSYSTEM
2.1.2.2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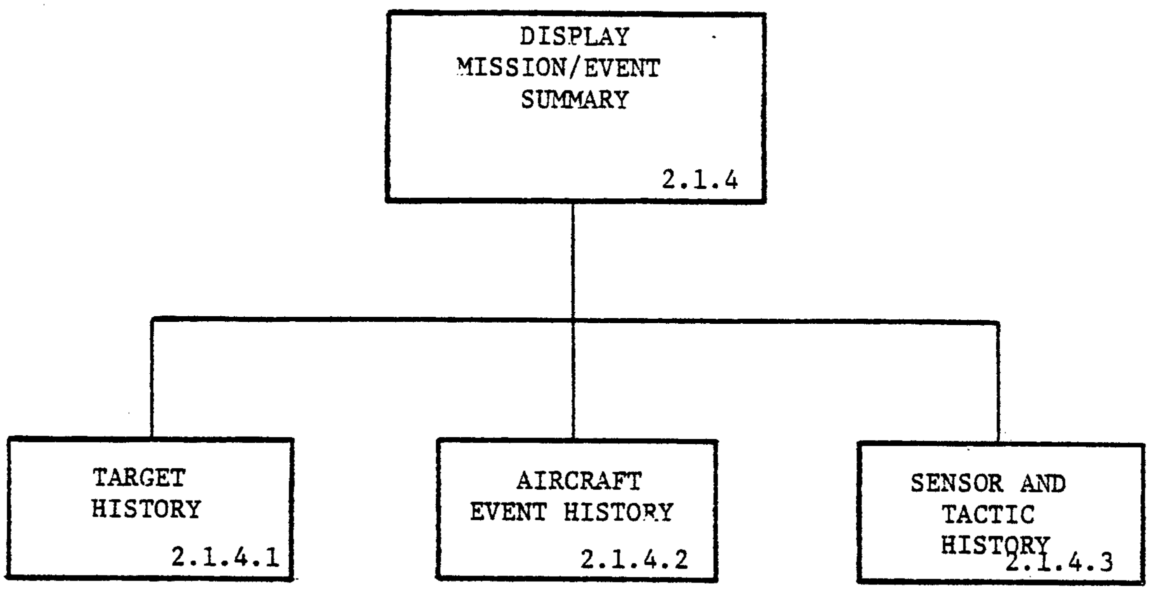
ENVIRONMENTAL SPECIFICS
2.1.3.3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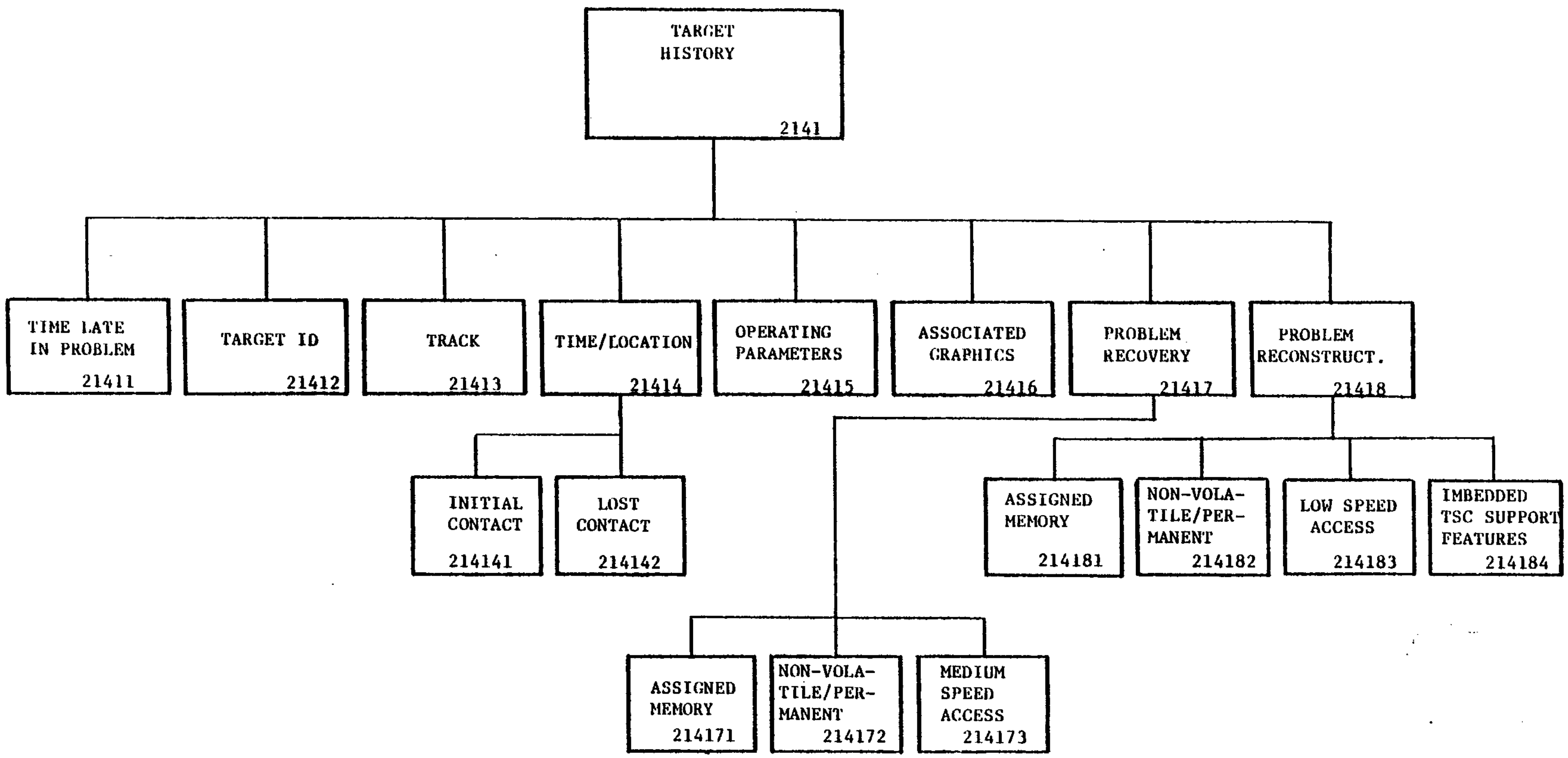
SENSOR AND TACTIC HISTORY
2.1.4.3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TARGET ID 21412
TRACK 21413
TIME/LOCATION 21414
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ASSOCIATED GRAPHICS 21416
PROBLEM RECOVERY 21417
PROBLEM RECONSTRUCT. 21418
INITIAL CONTACT 214141
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ASSIGNED MEMORY 214171
NON-VOLA-TILE/PER-MANENT 214172
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LOW SPEED ACCESS 214183
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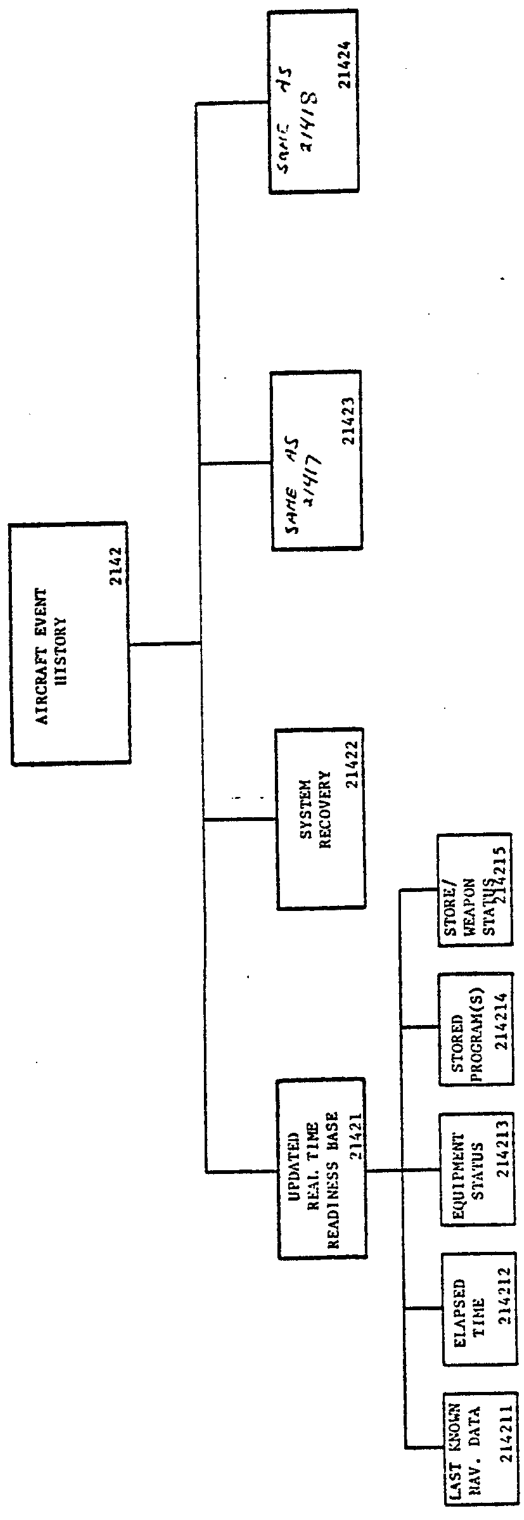
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LAST KNOWN NAV. DATA
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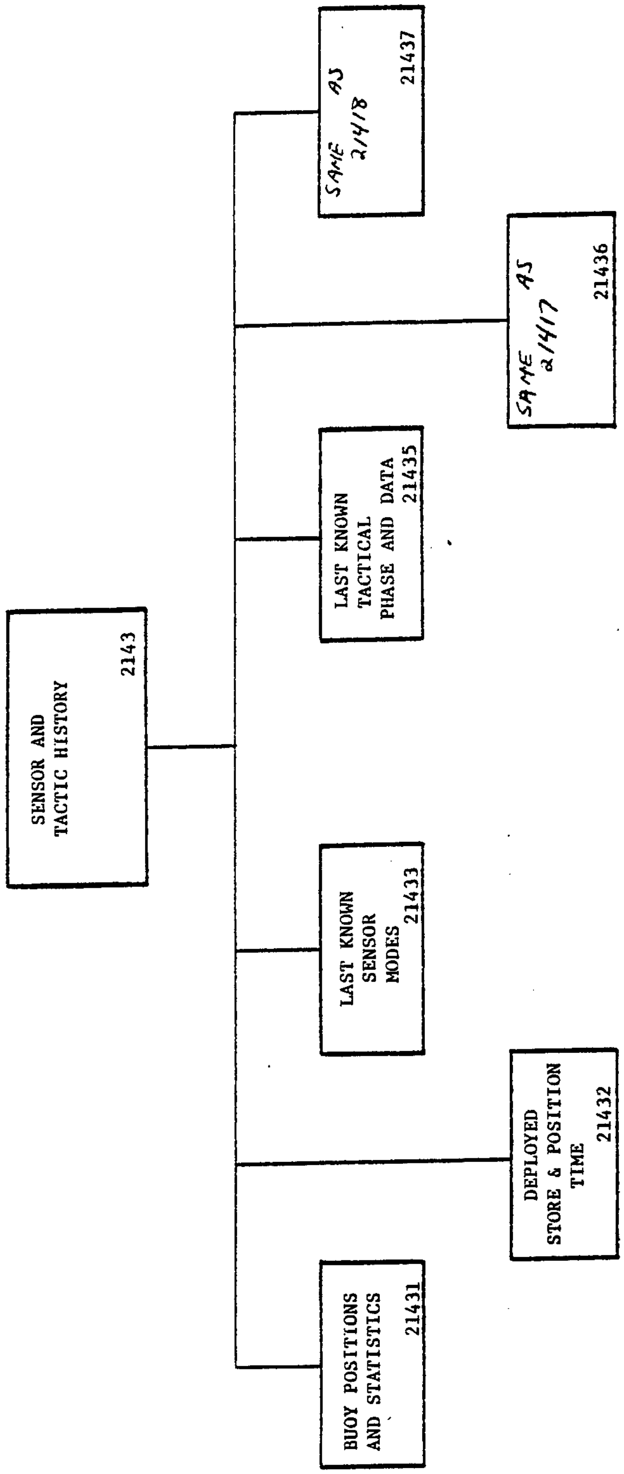
STORE/ WEAPON STATUS
214215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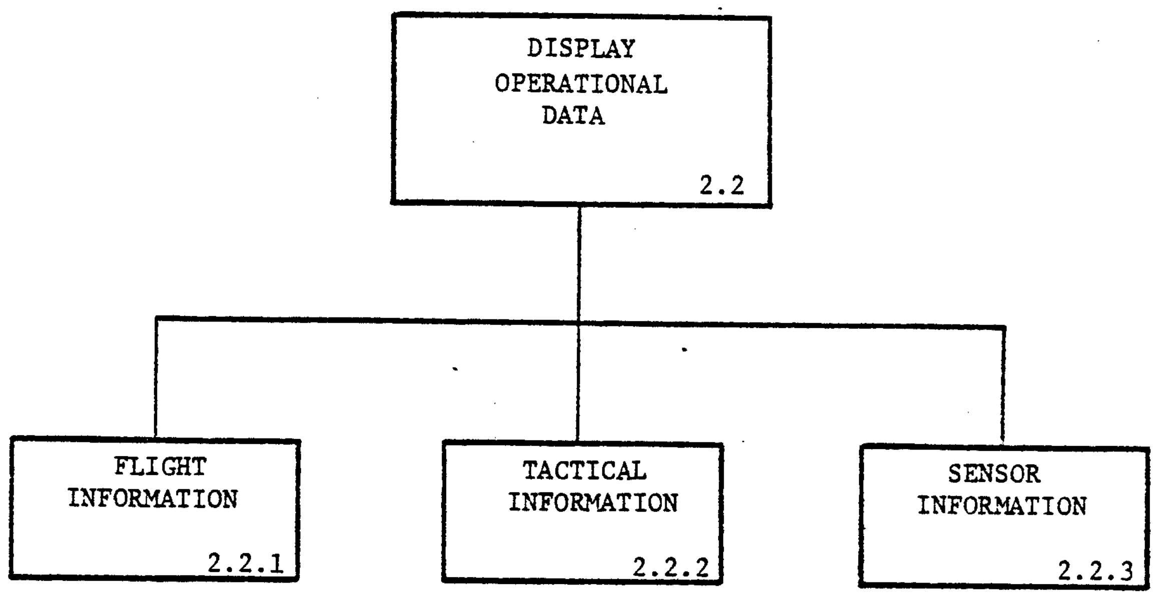
LAST KNOWN TACTICAL PHASE AND DATA 21435
SAME AS 21417 21436
SAME AS 21418 21437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SENSOR
INFORMATION
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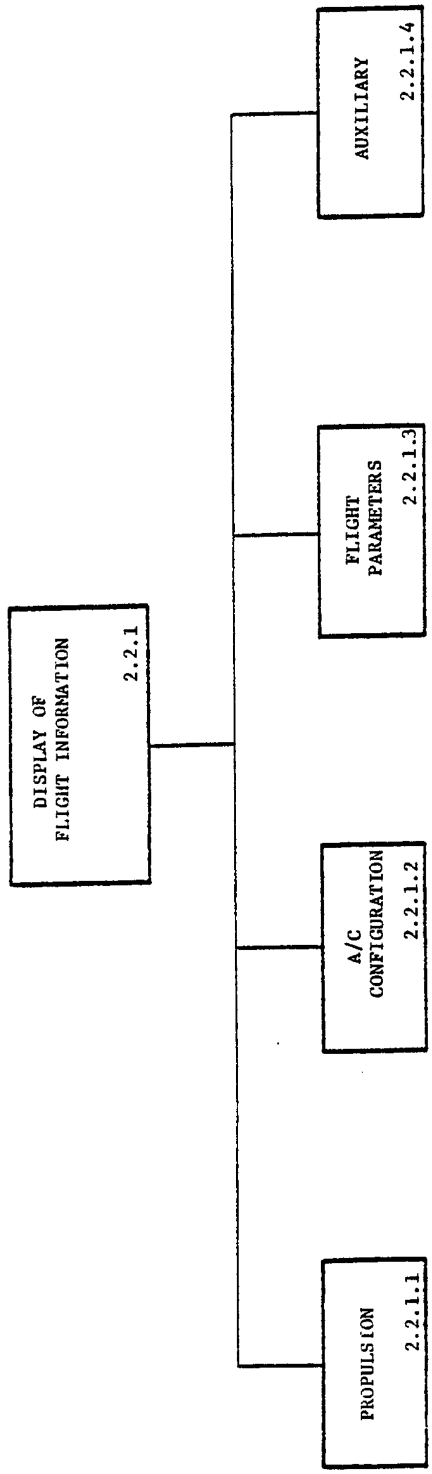
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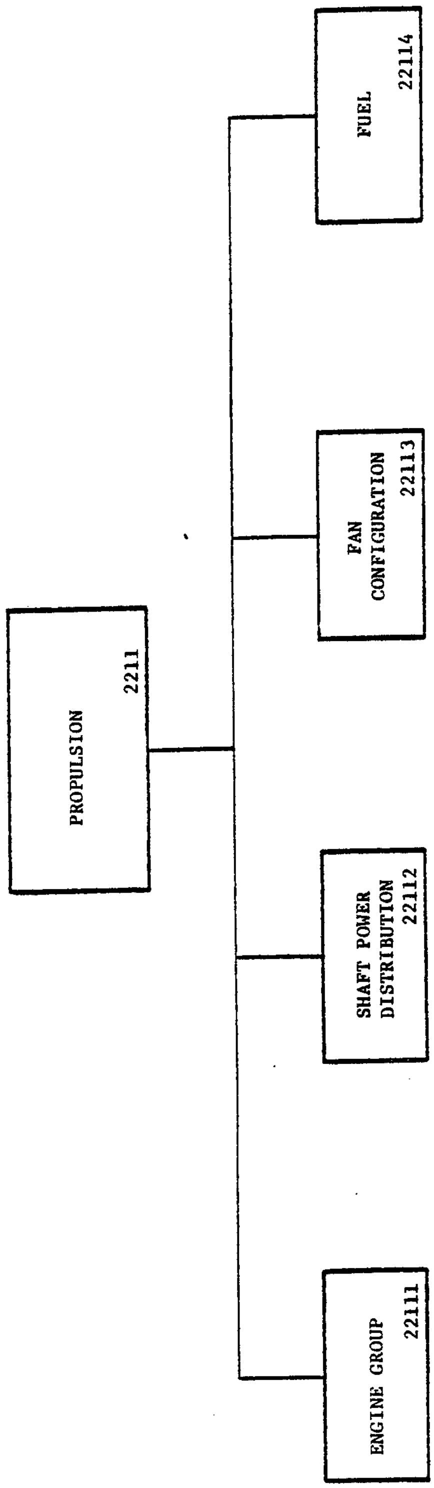
FLIGHT
PARAMETERS
2.2.1.3
AUXILIARY
2.2.1.4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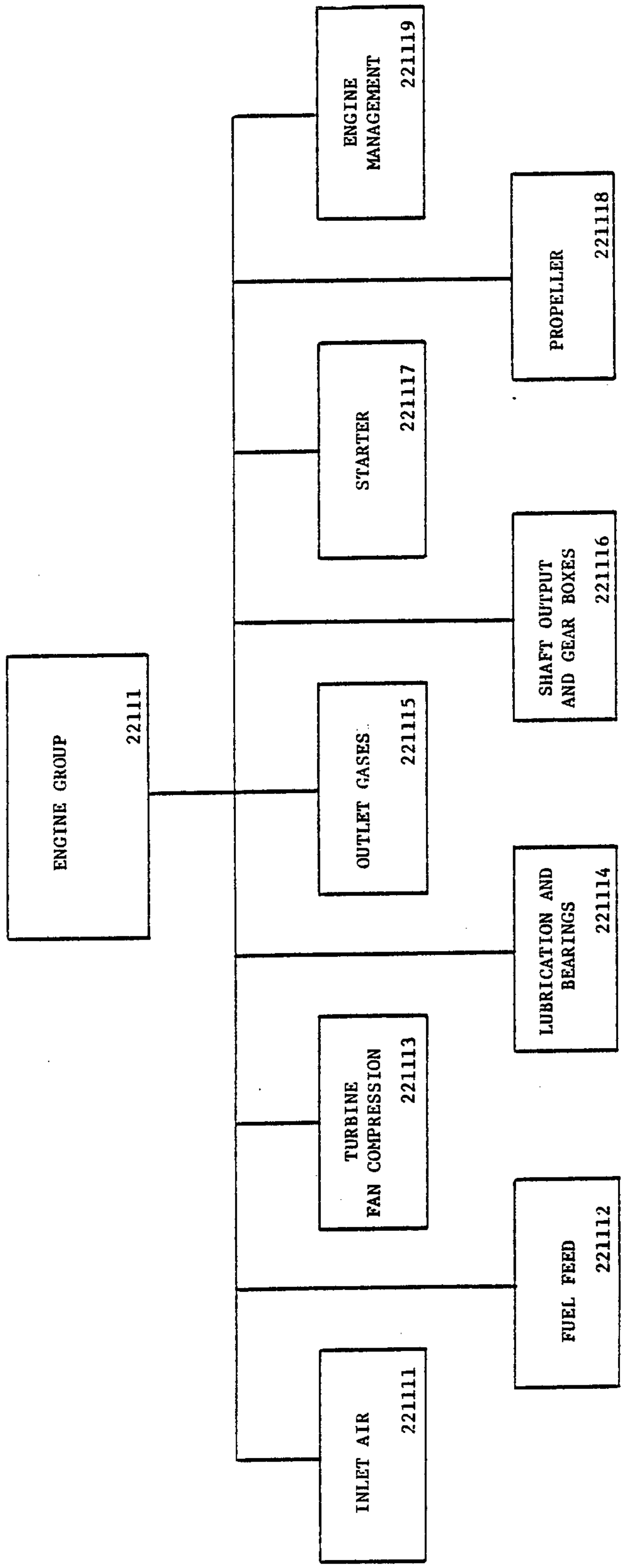
CONFIGURATION
22113
FUEL
22114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STARTER 221117
PROPELLER 221118
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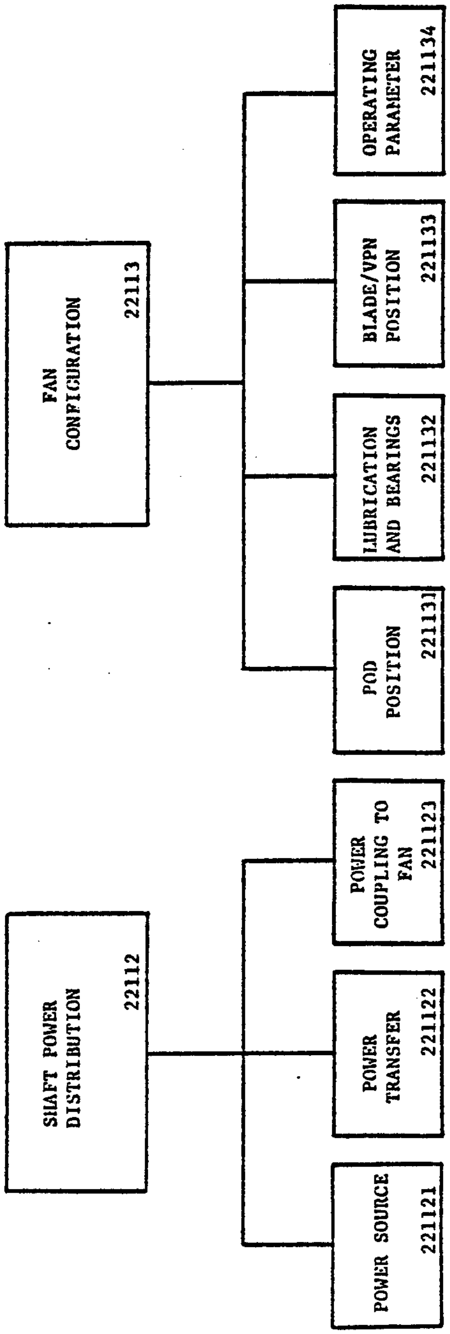

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POWER COUPLING TO FAN 221123
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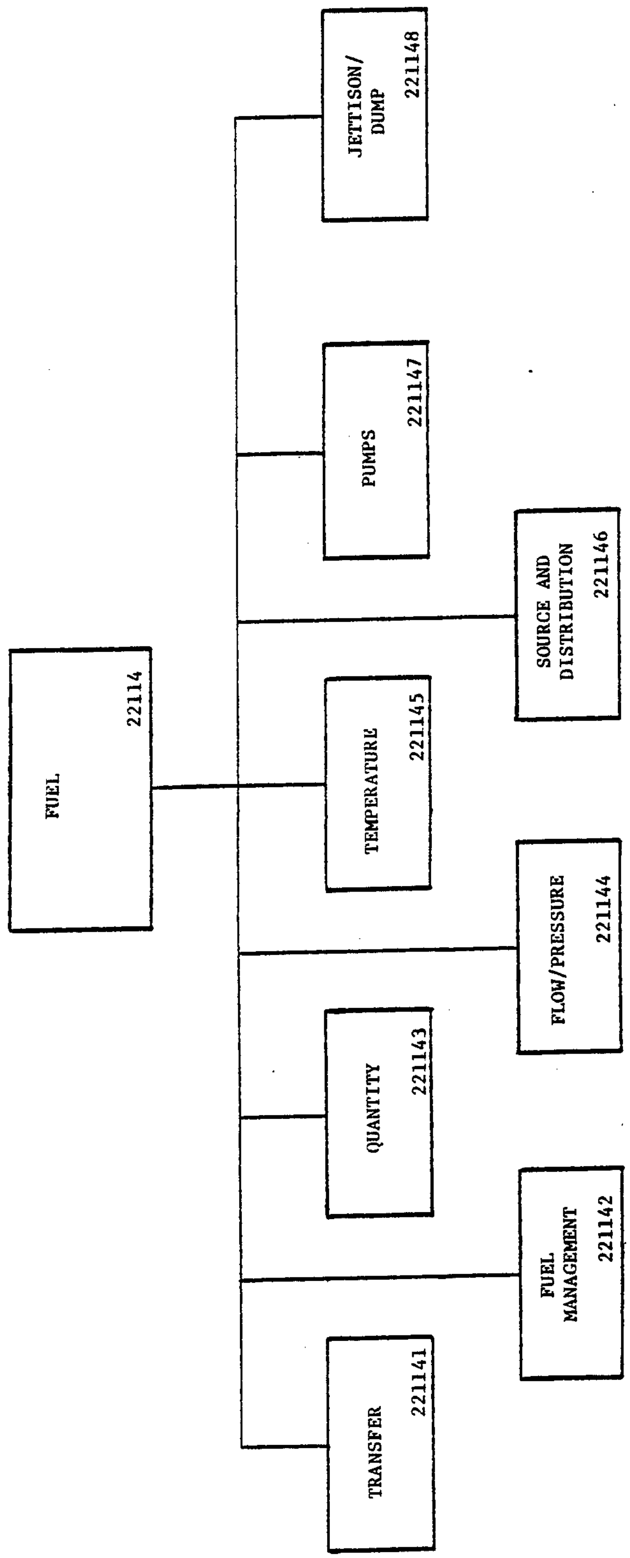
BLADE/VPN POSITION 221133
OPERATING PARAMETER 221134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SOURCE AND DISTRIBUTION
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PUMPS
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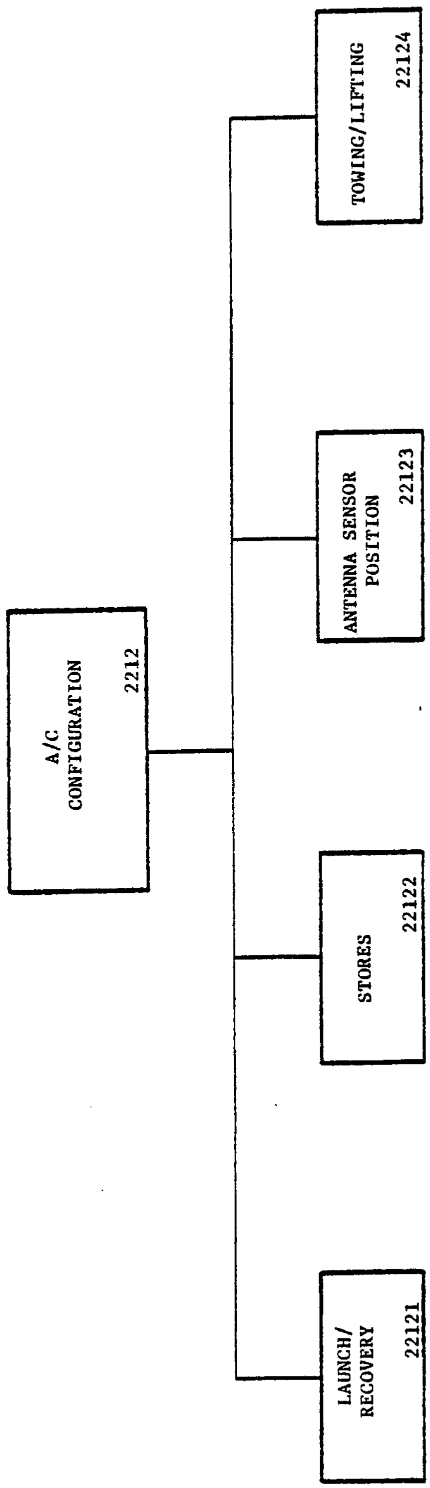
JETTISON/ DUMP
221148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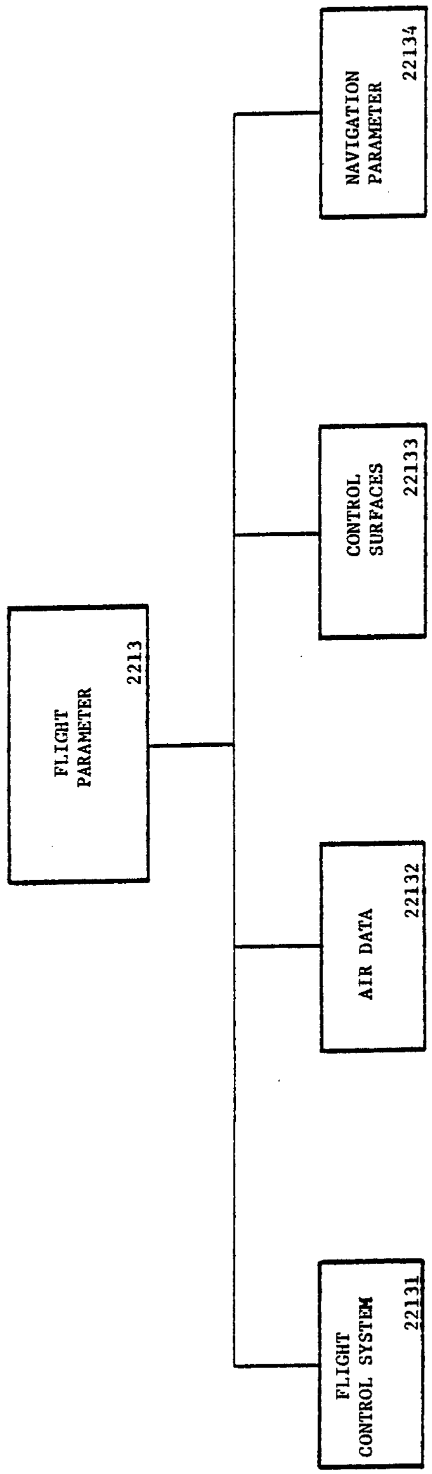
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AIR DATA
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CONTROL SURFACES
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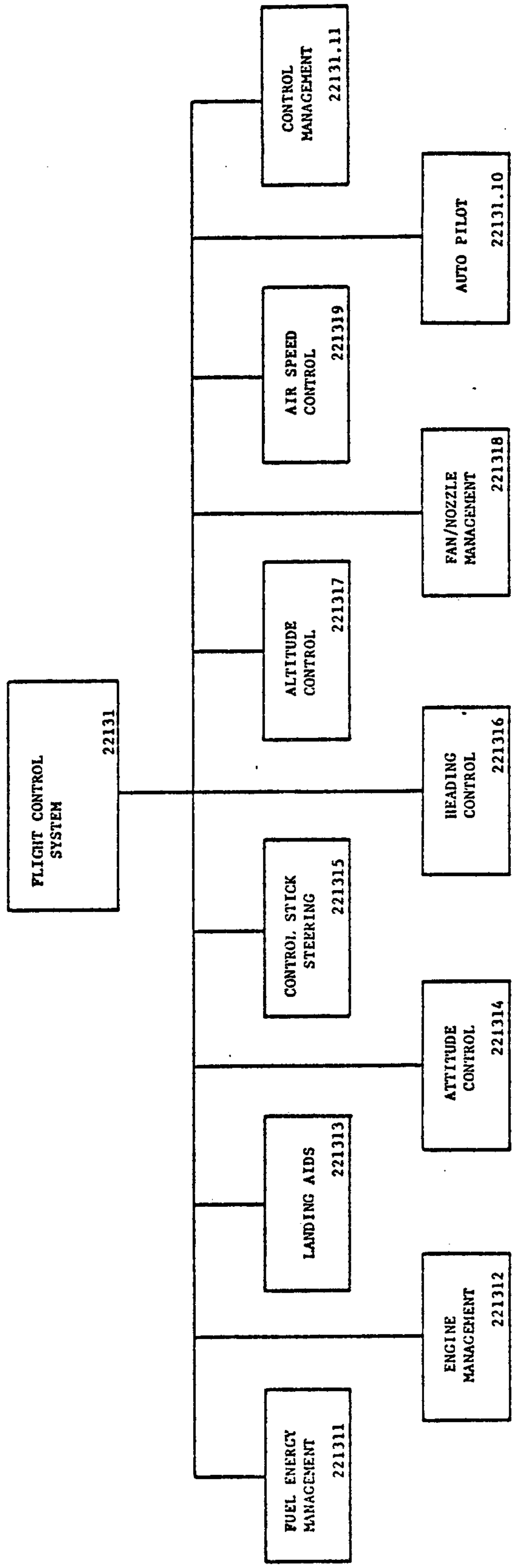
NAVIGATION PARAMETER
22134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ENGINE MANAGEMENT
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CONTROL STICK STEERING
221315
HEADING CONTROL
221316
ALTITUDE CONTROL
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CONTROL MANAGEMENT
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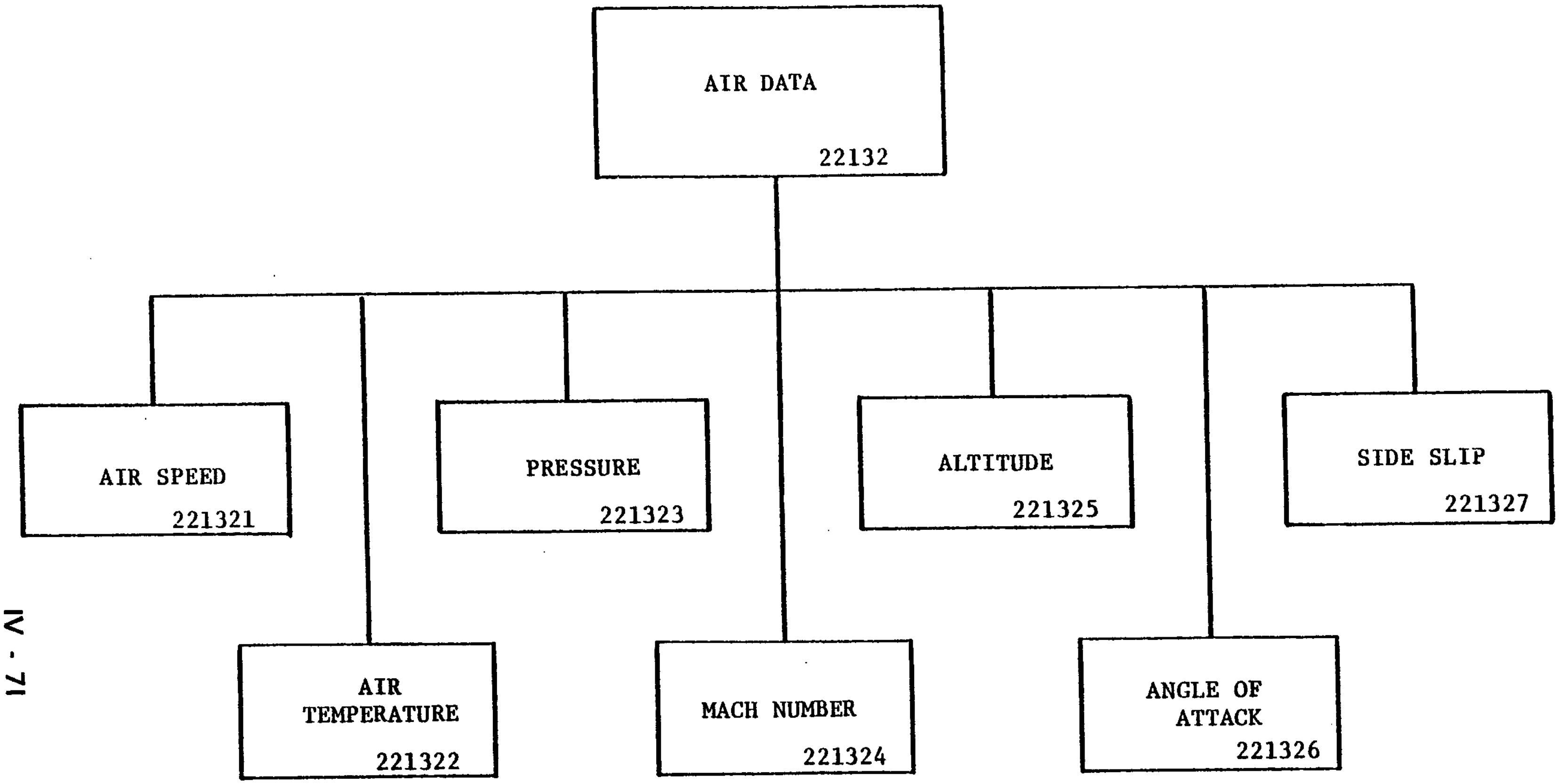
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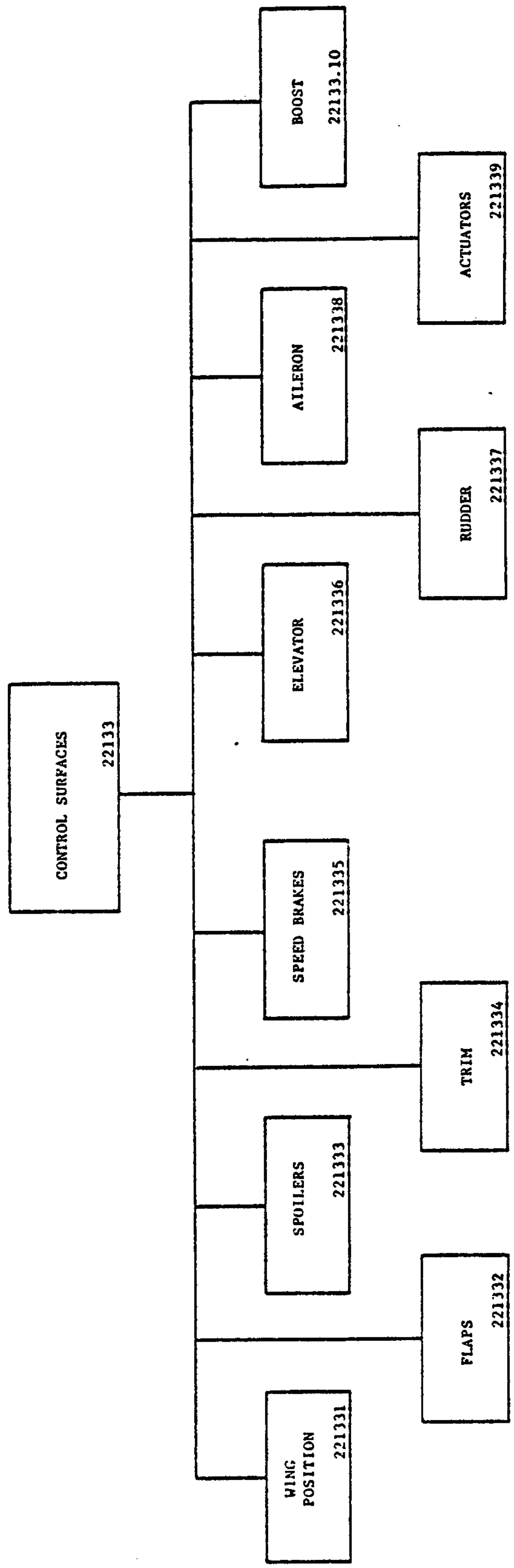
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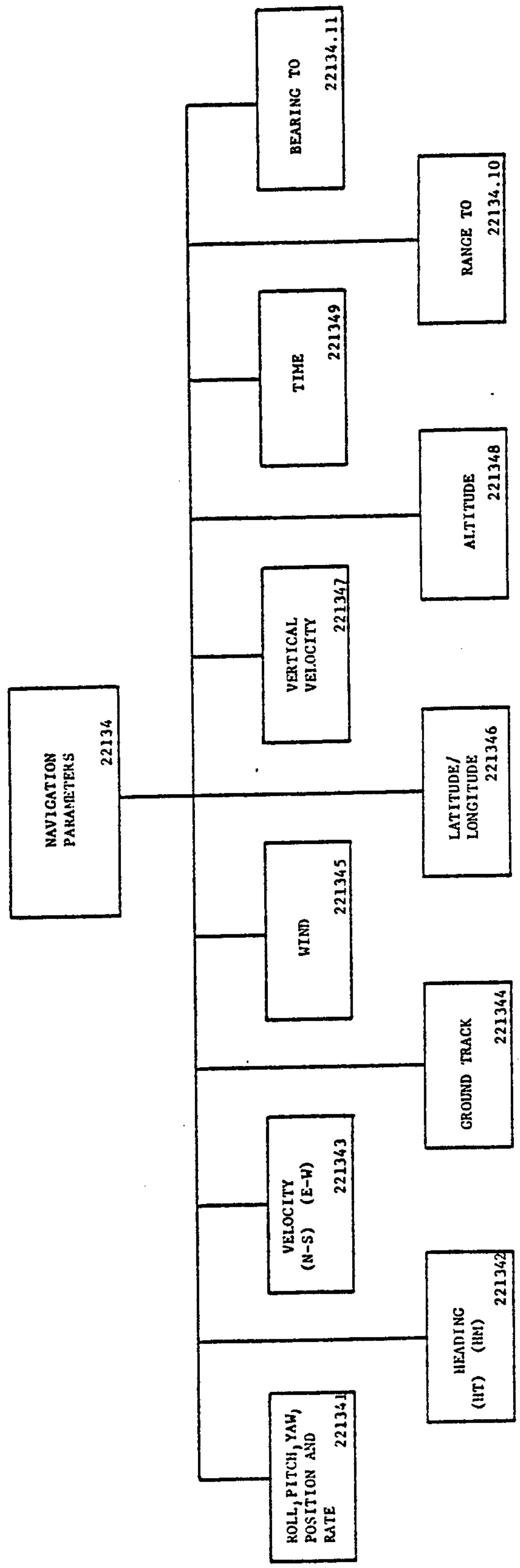
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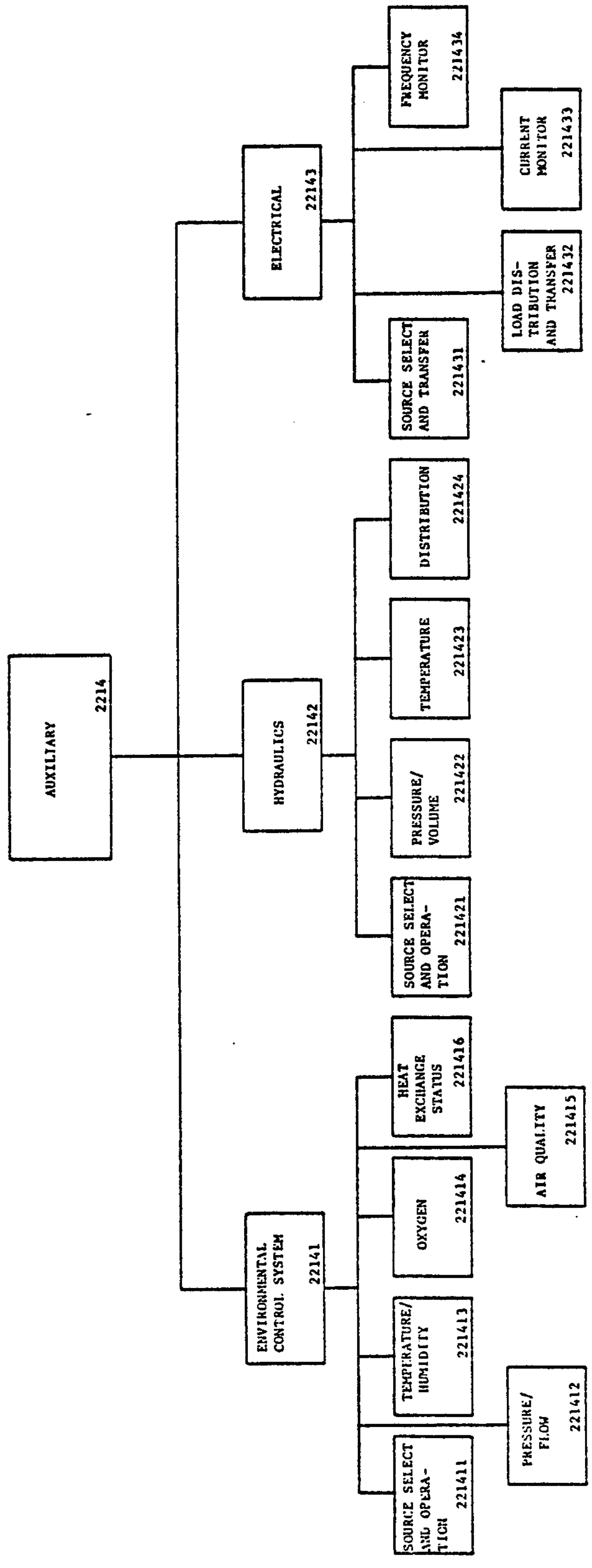
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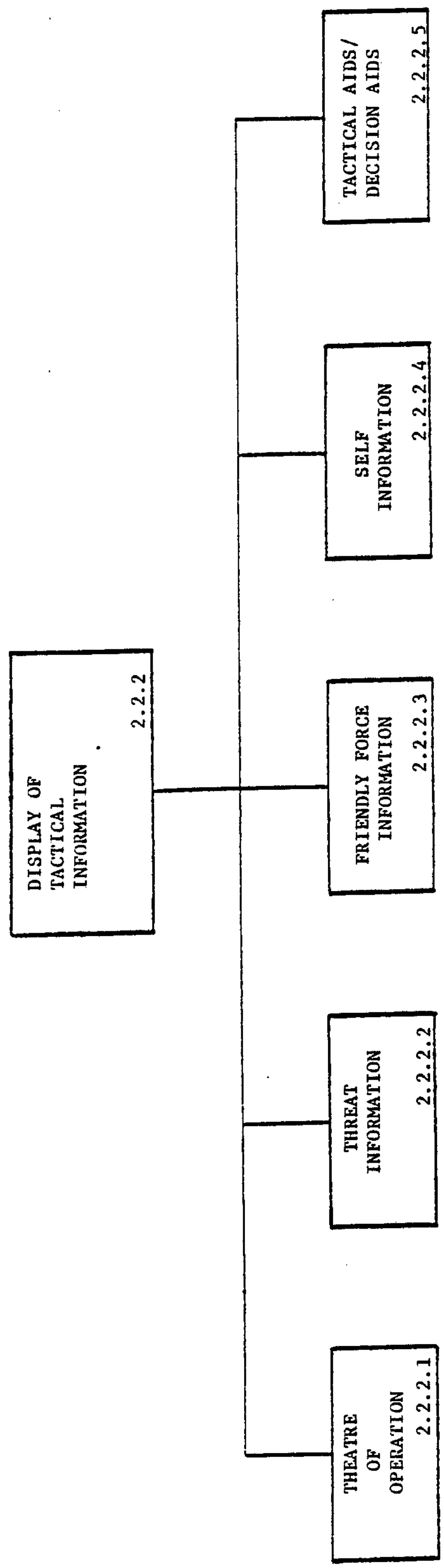
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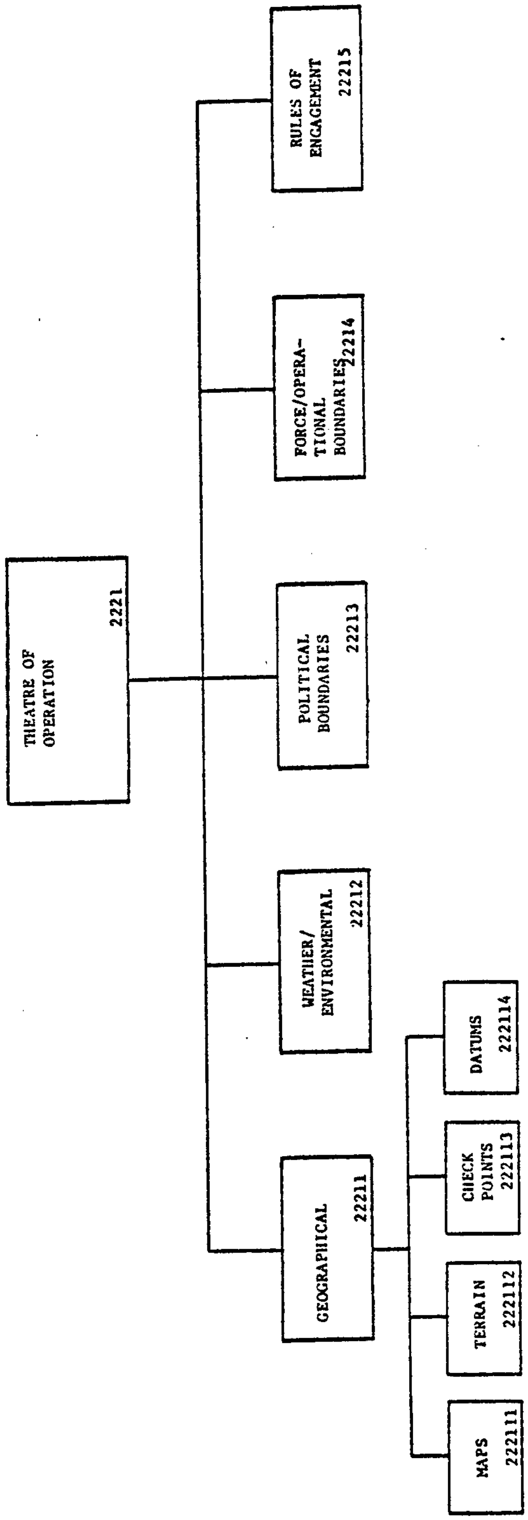
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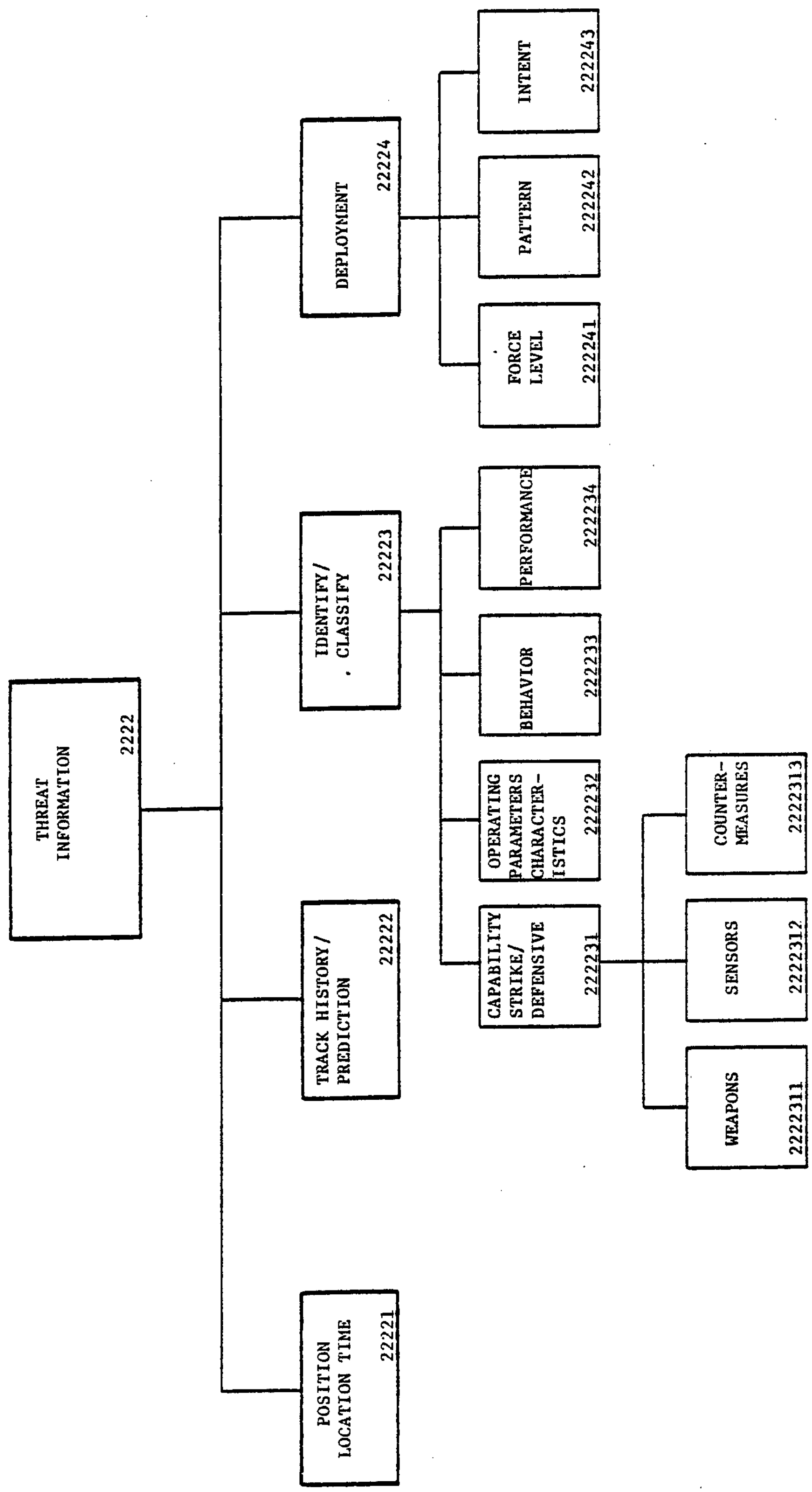
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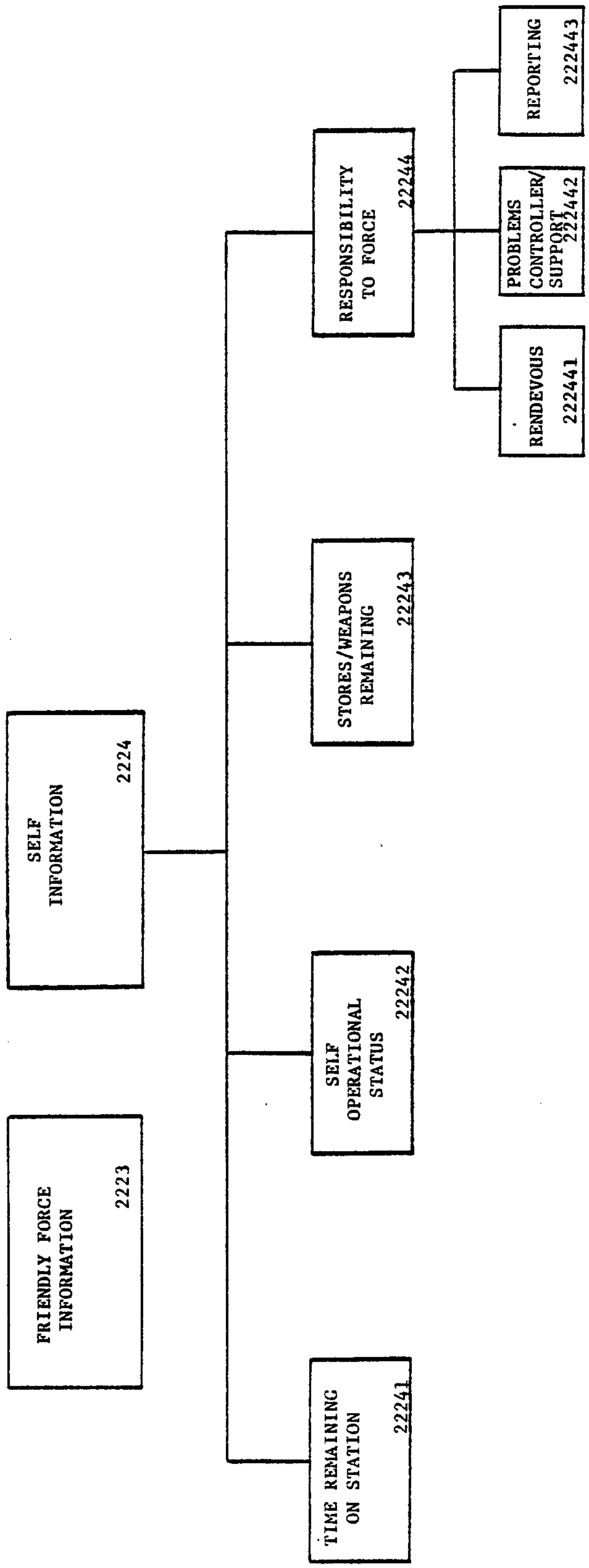
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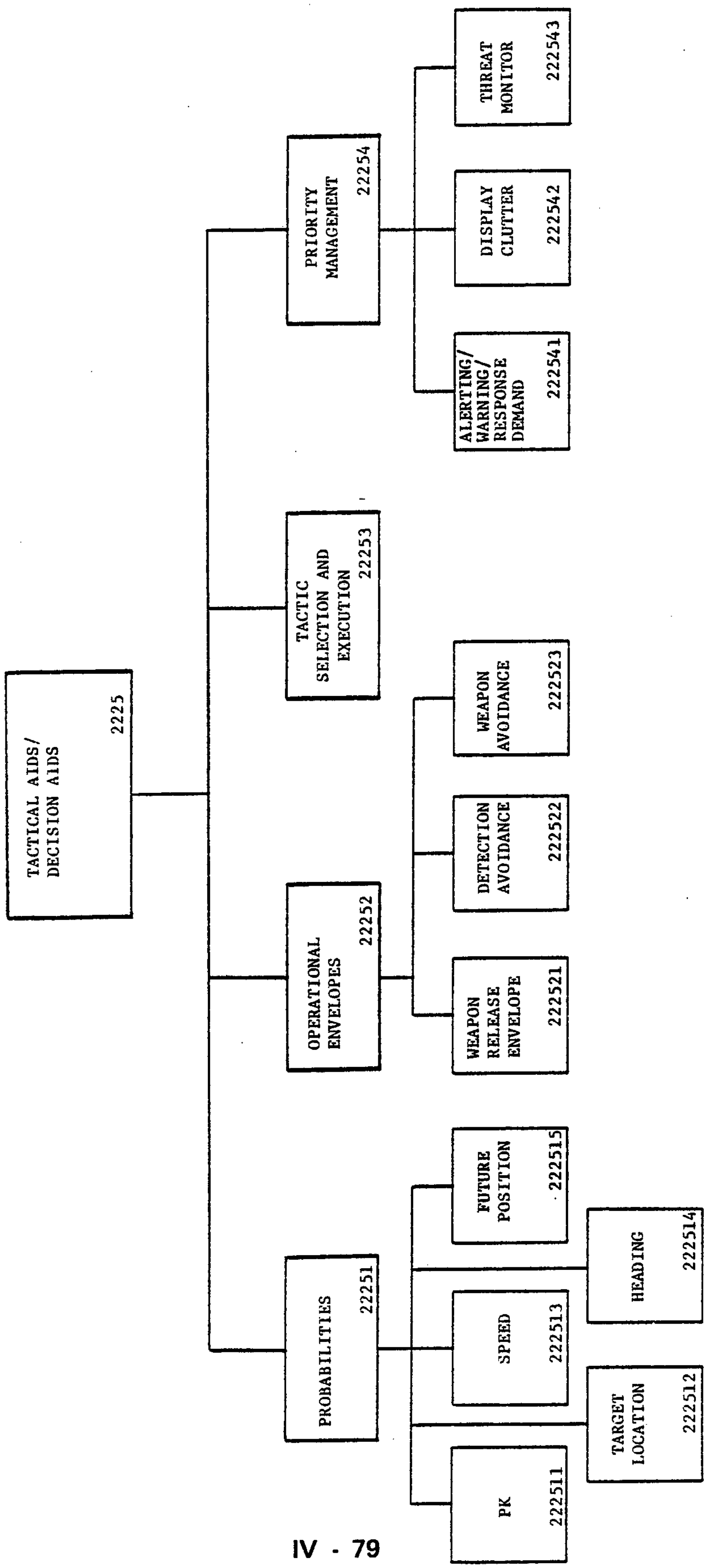
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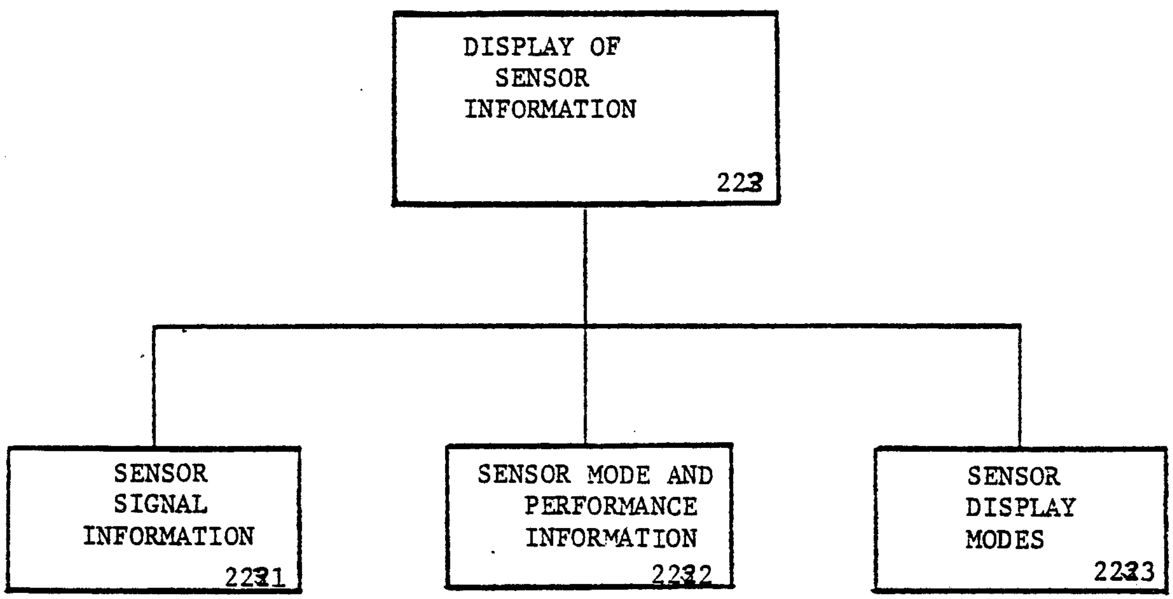
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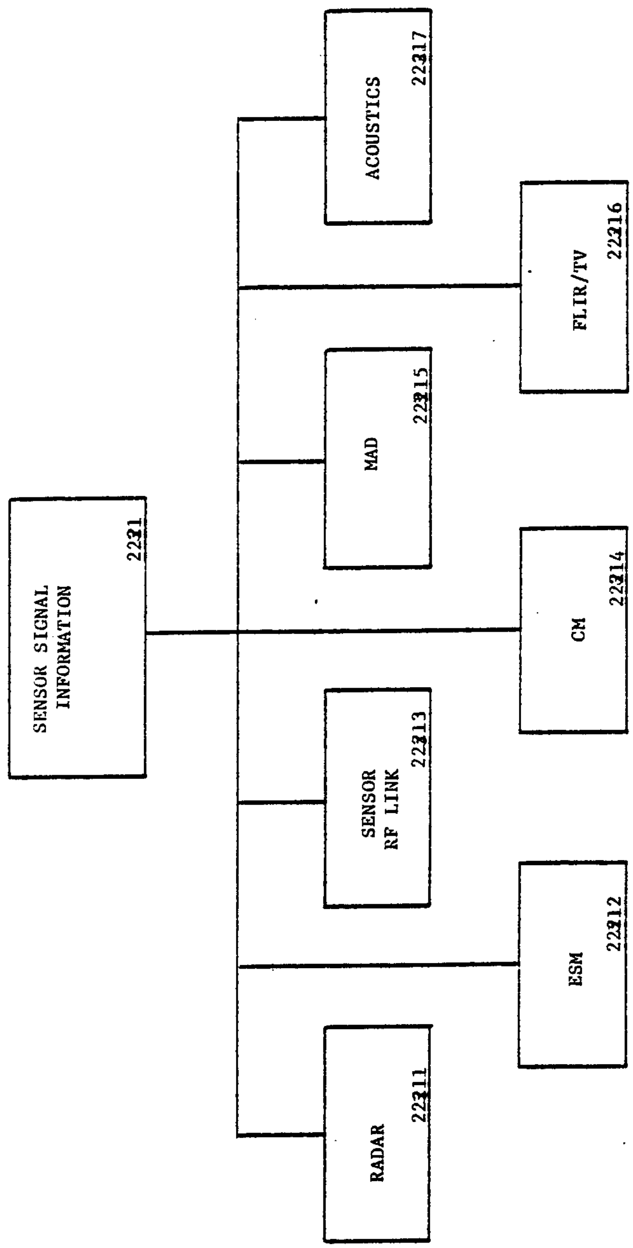
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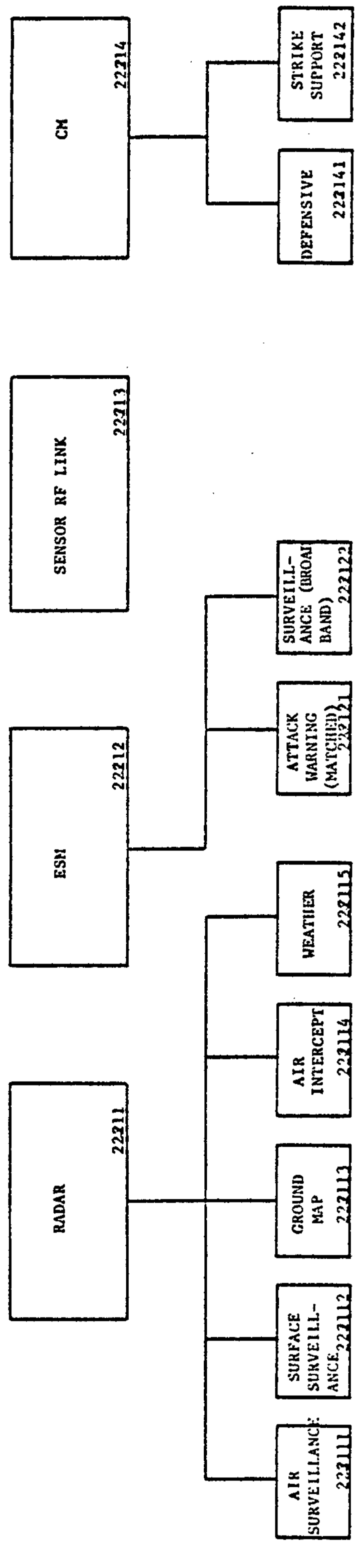
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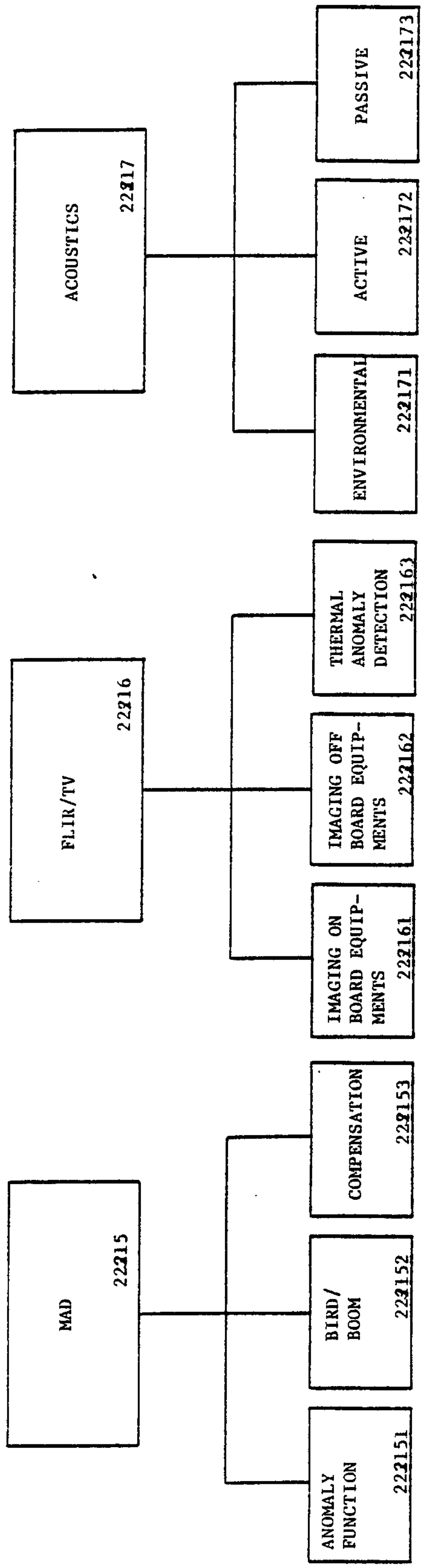

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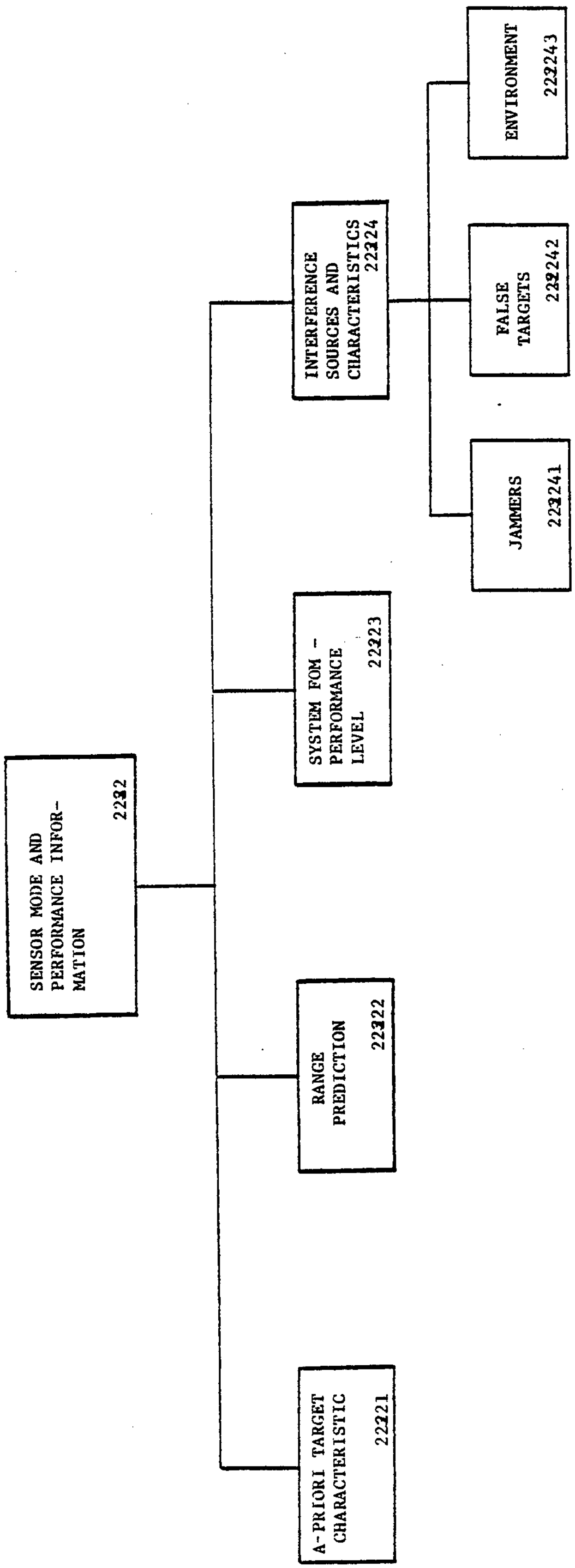
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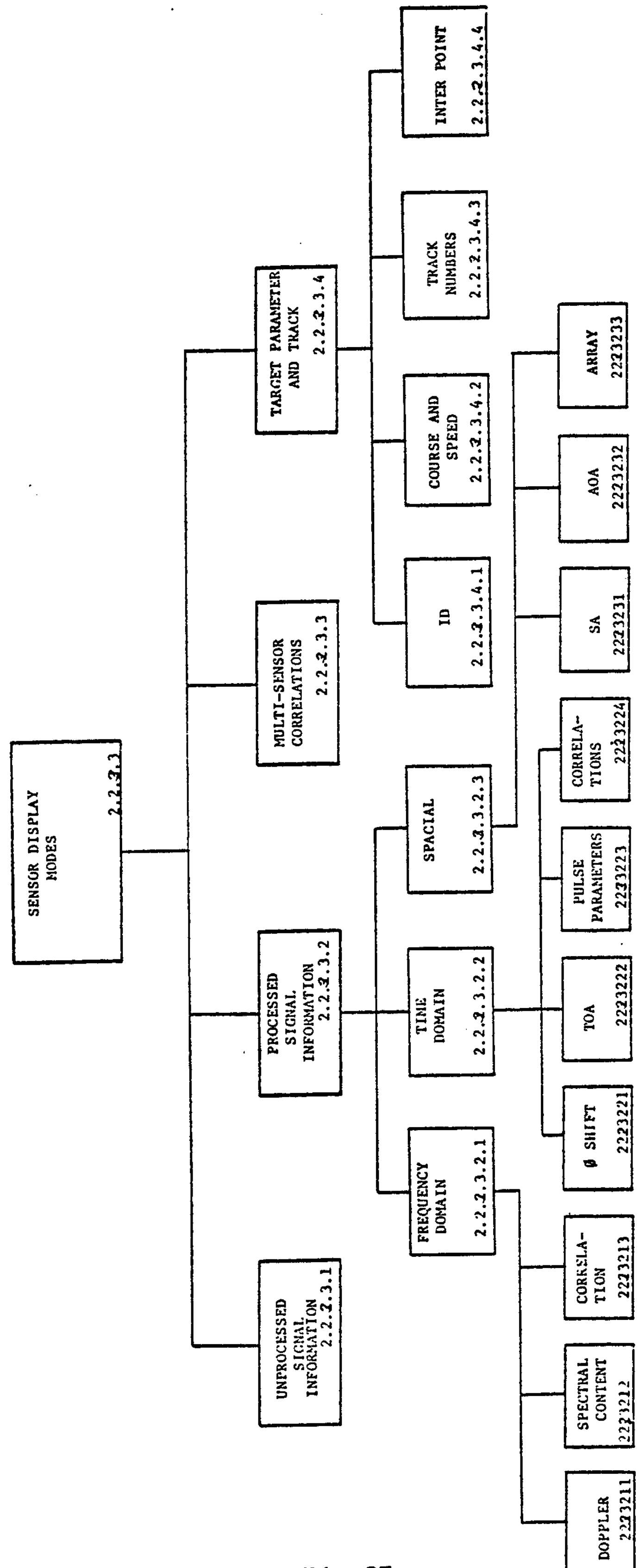

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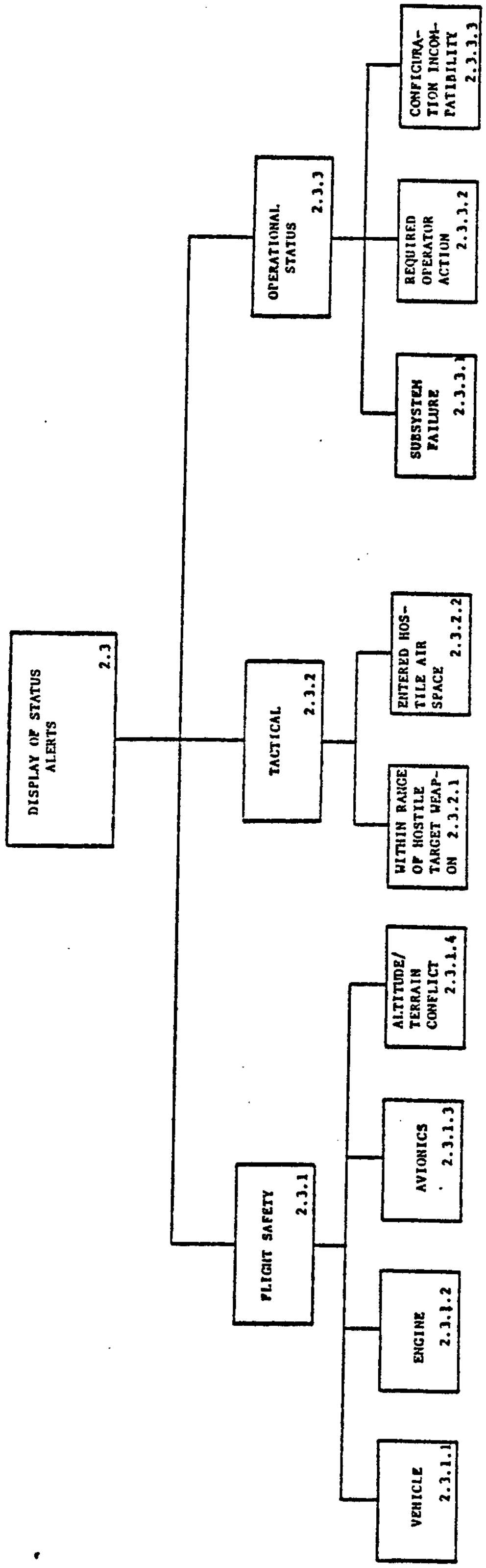
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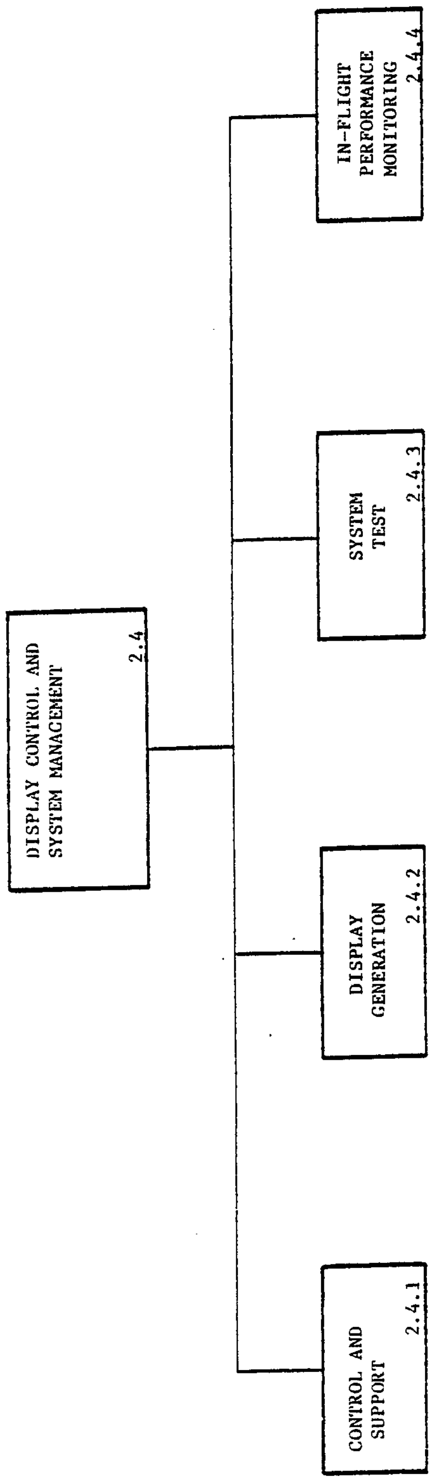
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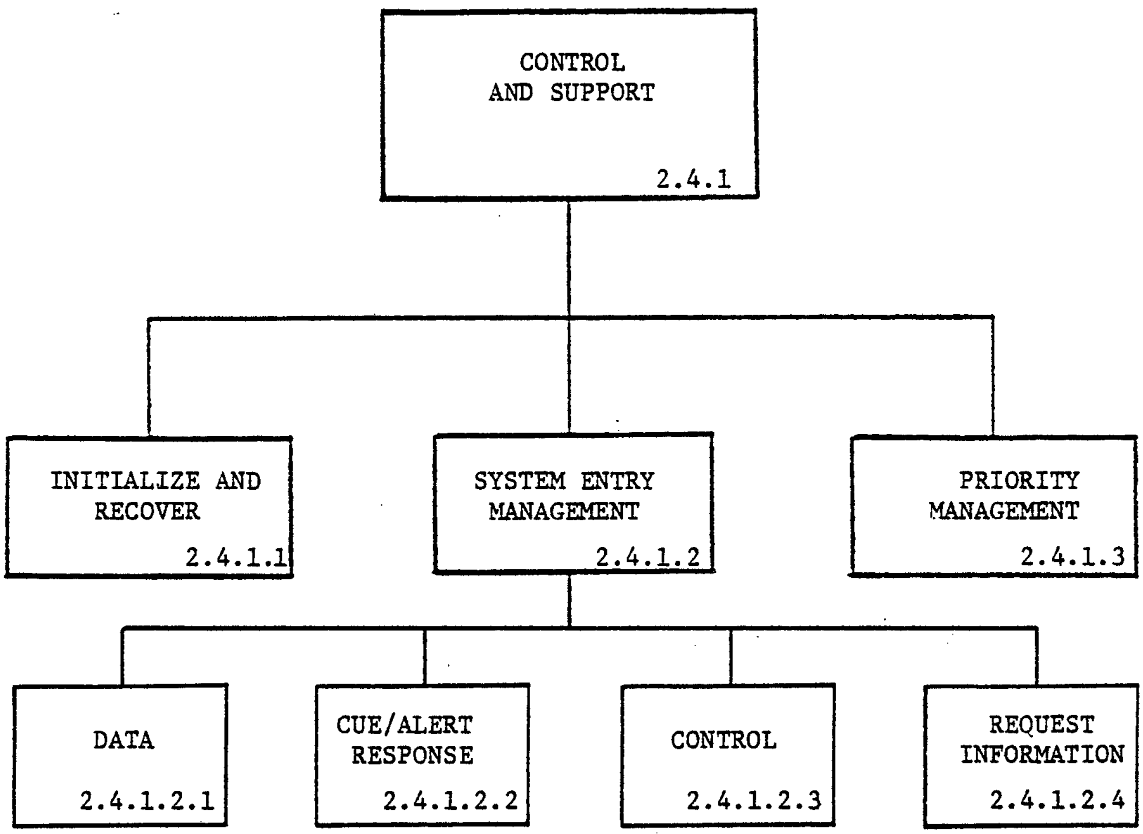
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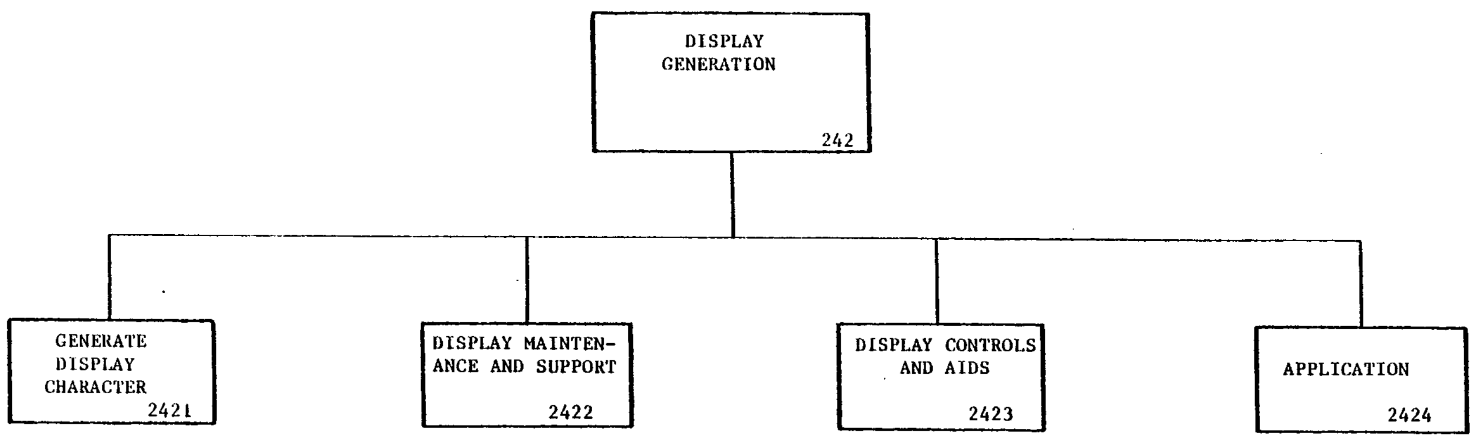

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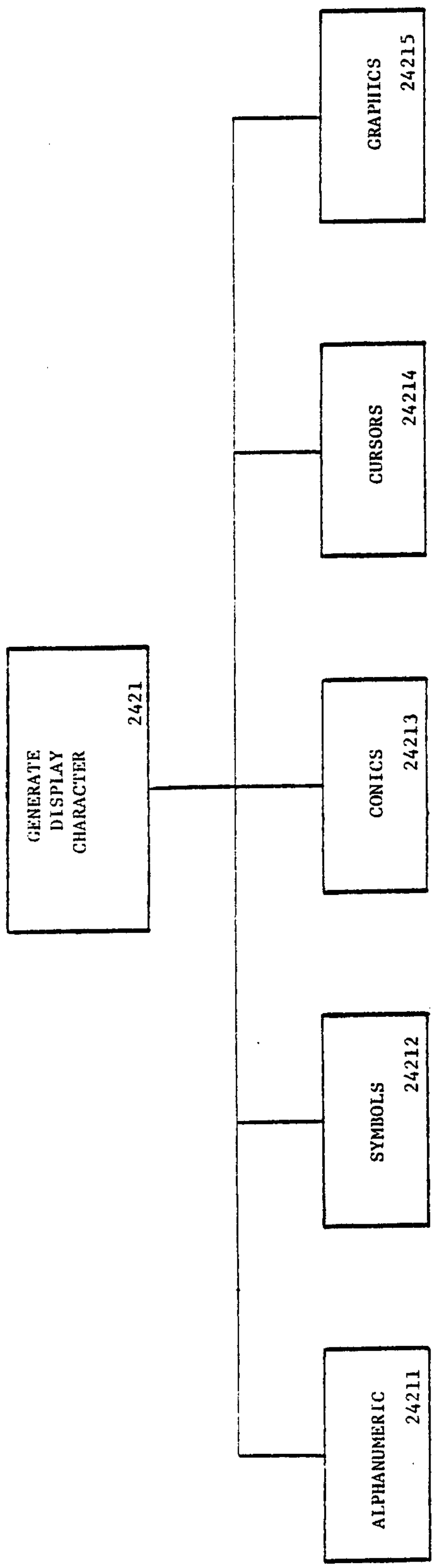
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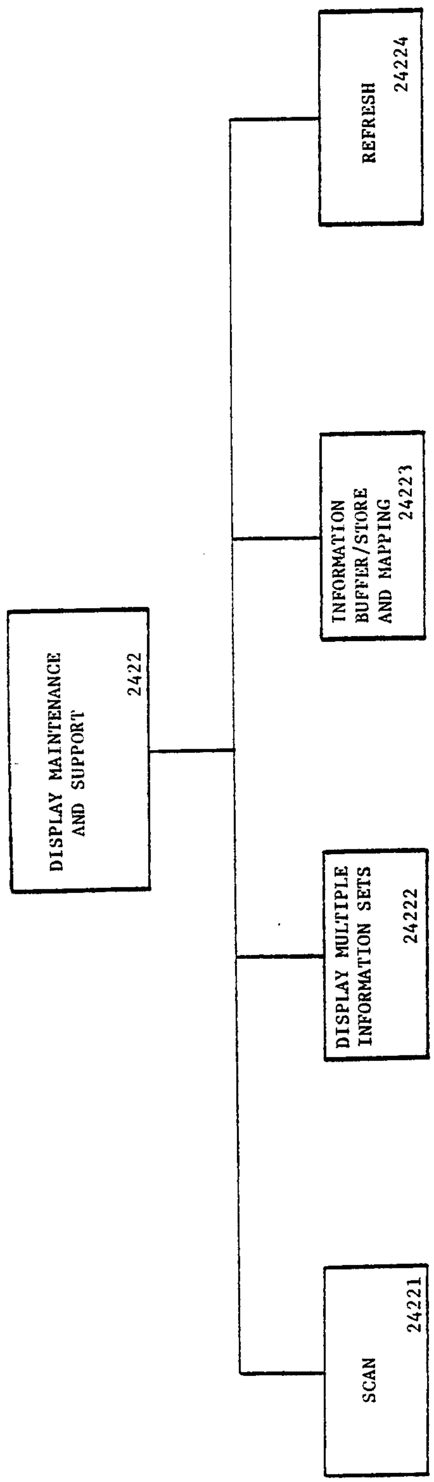
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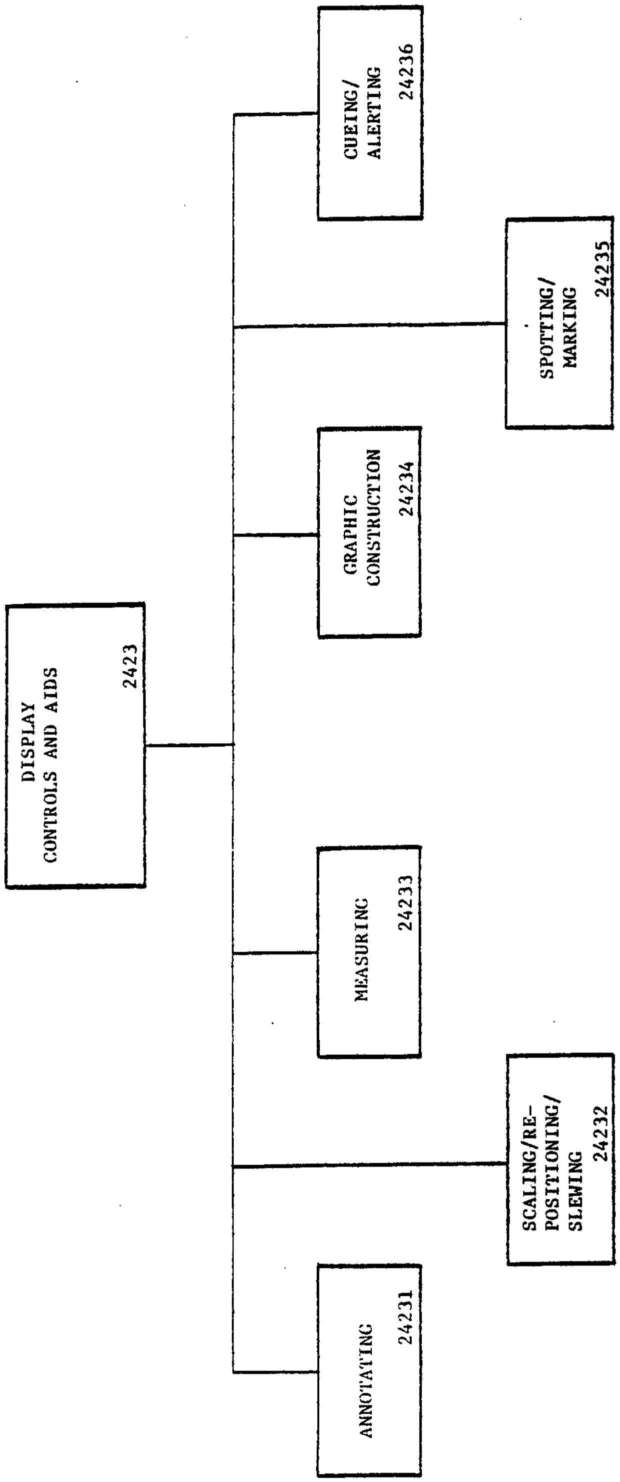
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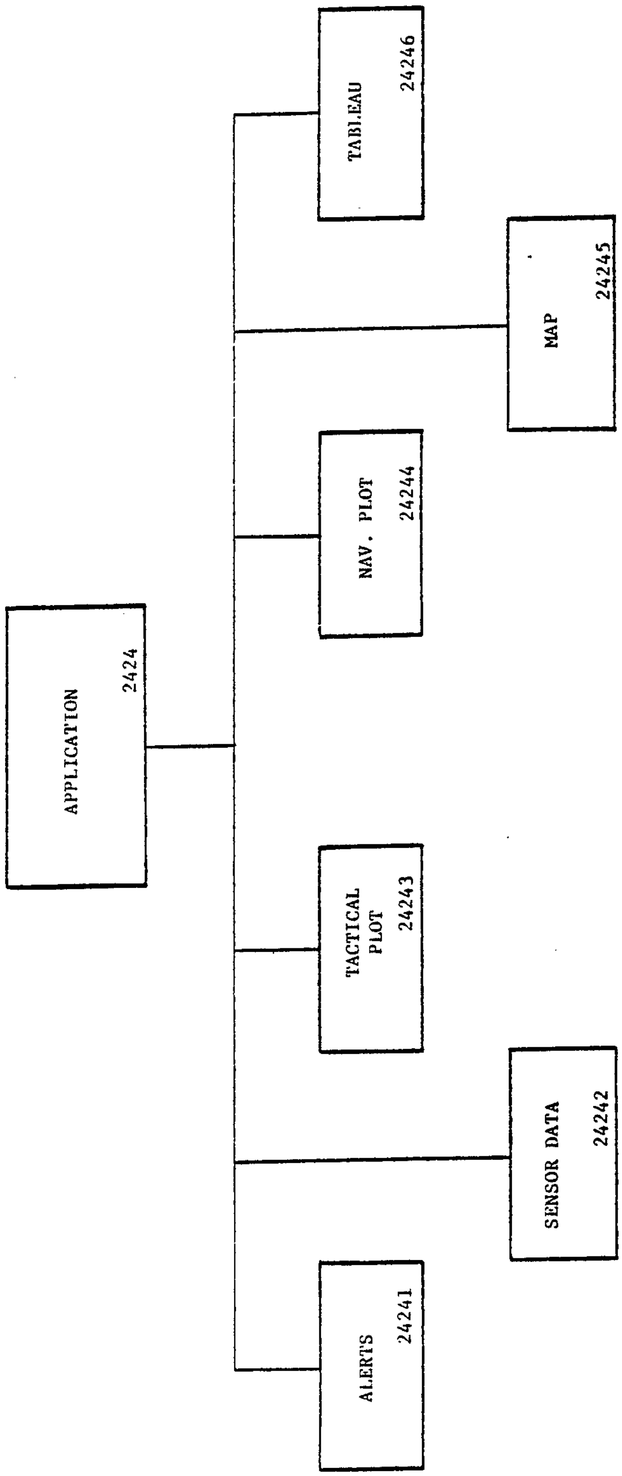
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3.0 ELECTRICAL SUBSYSTEM POWER MANAGEMENT

3.1 ACCOUNTING

Functional Description - The accounting function is responsible for maintaining the status of the power generator, and load feeder; and monitoring the voltage level, total power being consumed and the quality of the power. All measurements are routinely reported to the display and control subsystems, via the system controller. In addition, the accounting function maintains a table of alert status values, and when any measurement falls within the table range, the accounting function will issue an alert to both the display and control subsystem and the control and protection distribution function of the electrical power management subsystem.

Inputs - Measurements of voltage, current and power quality.

Outputs - Reporting of power parameters and any associated alert status to display and control subsystem and to control and protection distribution function of the electrical power management subsystem.

3.2 CONTROL AND PROTECTION DISTRIBUTION

Functional Description - The control and protection distribution function is concerned with assignment of electrical loads and sources within the aircraft. The function will initially configure the electrical system based upon preflight configuration data. Source and load assignments will be changed automatically by this function as inputs are received from the accounting function, to provide for crew safety, equipment protection and optimum system loading. The pilot will have the capability to override the electrical system configuration. If the control and distribution function determines that the configuration directed by the pilot would cause a hazardous condition, it will issue an alert to the display system. The electrical system will not be reconfigured until the pilot acknowledges this alert. The electrical system configuration will be routinely reported to the display and control subsystems to be displayed at the operator's request.

Inputs - Electrical system parameters obtained from the accounting function and pilot directed system overrides.

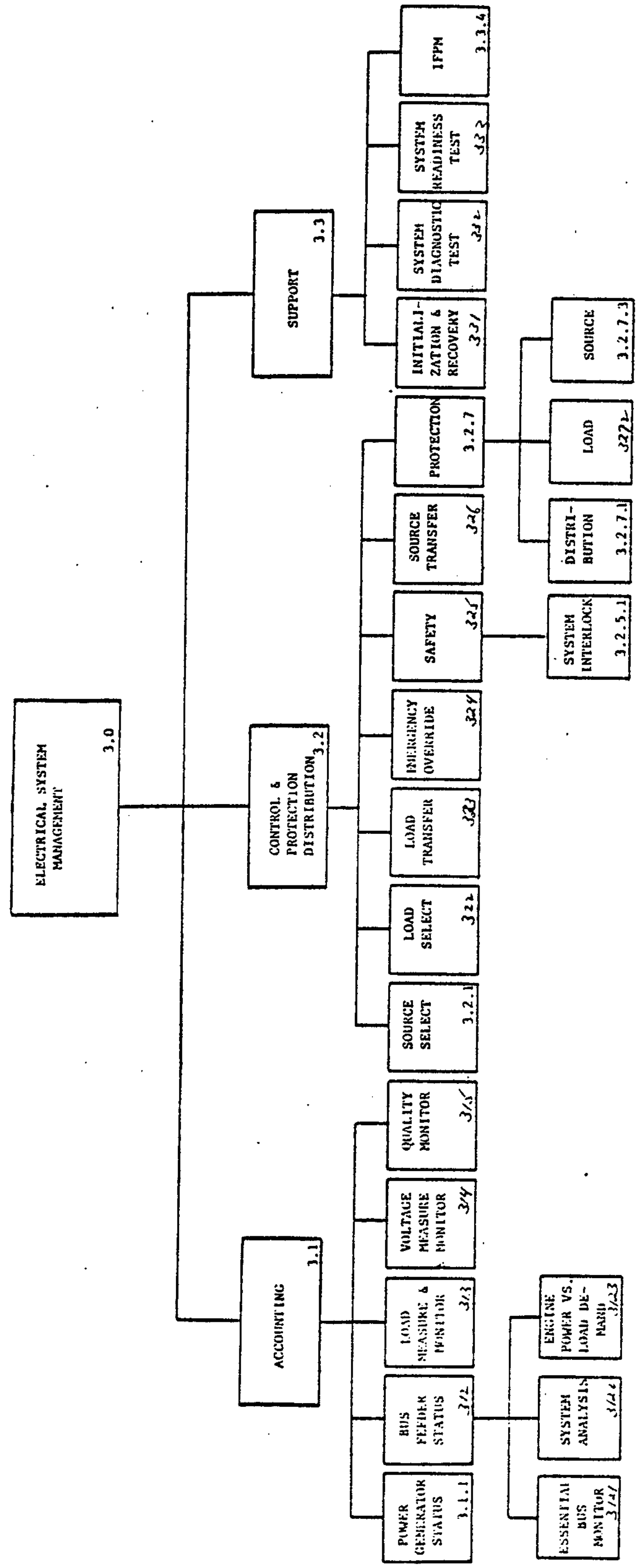
Outputs - Configuration of electrical system and reporting configuration status to display and control subsystem.

3.3 SUPPORT

Functional Description - The support function is responsible for performing system diagnostic test and readiness test as requested by the system controller, and reporting the test results to the display and control subsystem. The support function will also routinely execute an IFPM program as a means of determining that the subsystem processor is operating properly. If the IFPM program detects a processor failure, the support function will issue an appropriate alert to the display and control subsystem. If the alert is not cleared by the pilot, the system controller will automatically reconfigure another subsystem processor, whose function is least critical to the V/STOL mission, to assume the electrical subsystem processing tasks. To provide for an orderly reconfiguration, it is necessary for the support function to provide recovery data periodically to the system controller. The controller will use this data whenever it is required to initialize an electrical subsystem processor.

Inputs - Requests from the system controller to perform system diagnostic and readiness tests.

Outputs - Results of system diagnostic, readiness and IFPM tests reported to system controller and display and control subsystem. Recovery data transmitted to system controller.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4.0 NAVIGATION

The Navigation Functional Area is concerned with the determination, in a variety of relative and geodetic coordinate systems, 3-dimensional position and velocity, as well as acceleration and attitude. This information will be utilized in addition to its basic function of directing the movements of a craft from one point to another but also in the support of other aircraft systems in the accomplishment of the aircraft's mission.

There are basically three ways of defining observed vehicle motion:

a. Earth Navigation - Typically, an aircraft navigation system is initialized with respect to a latitude/longitude and local vertical/north reference; this mode is used for general enroute purposes.

b. Point Navigation and Associated Operations - In the vicinity of a specified point of interest (such as a designated target, landing area), the aircraft is operated in accordance with its relation to that point, irrespective of latitude or longitude (and, in the targeting case, irrespective of north direction).

c. Air-to-Air Mode - In this mode, the aircraft is relatively independent of the earth below and all operations are dictated by its relation to a specified airborne platform (not necessarily restricted to air combat maneuver but including in-flight refueling and all other functions for which another airborne vehicle exerts dominating influence).

In order to accomplish its navigation function, an aircraft's navigation system essentially utilizes two types of input information:

a. Direct position data from radio aids, radio checkpoints, stellar, and artificial satellites.

b. Dead reckoning data obtained from inertial, doppler or air data sensors as a means of extrapolating present position. A heading reference is required in order to resolve the velocities into the computational coordinates.

The navigation computer combines the direct position fixes and dead reckoning data into an estimate of the aircraft's position and velocity in a preselected coordinate system. The best estimates of the navigation information are combined with other sensor or mission information ultimately in order to support the aircraft in performing its mission.

The navigation output quantities that are of primary interest for the aircraft's navigation system support are:

a. Position - Current aircraft location will be parametrized according to the current operating mode. For earth based navigation, position is generally defined by geodetic latitude, longitude and altitude above mean sea level. Point navigation will typically define relative position by a cartesian vector from a target centered locally level coordinate frame. For air to air tracking, the relative position vector between tracked object and tracking aircraft will define position according to a chosen cartesian or spherical convention.

b. Velocity - Earth navigation typically calls for velocity in geographic coordinates, while point navigation may use a locally level frame with an independent azimuth reference. For air to air tracking, velocity as well as position is relative.

c. Aircraft Orientation - Roll, pitch, and heading angles constitute a typical parametrization but, since the north direction is ill defined at the poles, another azimuth reference is adopted at high latitude. Additional desired outputs may include time, rates of change, higher derivatives (e.g., acceleration) or simple functions of the above quantities (e.g., drift angle, ground track angle).

In order to accomplish these tasks, the navigation functional area is subdivided into the following major subfunctional areas:

- Enroute Navigation
- Terminal Area Navigation
- Flight Control Support
- Navigation System Management
- Safety
- Tactical Operations

4.1 ENROUTE NAVIGATION

Navigation functions and requirements may also be classified according to the portion of flight involved. Separate aids and systems with different characteristics are generally utilized for the two distinct phases (enroute and terminal area navigation). The functions which fall under the Enroute Navigation phase involve the navigational needs of an aircraft while it is transiting from location to location or between other functional navigation phases (terminal area and the mission objective area navigation). The enroute navigation functions fall into two subgroupings, namely those concerned with enroute control and those concerned with course designation.

4.1.1 ENROUTE CONTROL

The enroute control navigational functions involve those navigational functions performed while the platform is under the control or in support of either a military or a civilian air traffic control system. Furthermore, the functional enroute navigation requirements will differ depending on whether the enroute transit transgresses the ocean, land or underdeveloped land masses. Additionally, the enroute control functions can be further subdivided into the reporting, collision avoidance, and vectored phases.

The reporting function will provide the interchange of navigational information between the controlled platform and the system performing the controlling.

Collision avoidance provides the capability of detecting collisions and preventing them. For collision prevention, the required equipment may perform one or more of the following functions:

a. Detection of all potentially dangerous aircraft in the surrounding airspace.

b. Evaluate the actual occurrence or miss distance of a collision hazard.

c. Determine the precise maneuver needed, if any.

d. Specify when the maneuver should be initiated in order to ensure safe clearance.

The vectored function provides either the directed or controlled information necessary for the enroute navigation to a predetermined location.

4.1.2 COURSE DESIGNATION

While under the enroute control navigation functions, the aircraft is vectored toward the terminal area or mission objective area by a command and control system. Under this function, the aircraft is self-vectored to either the terminal or mission objective areas by either transgressing to a predetermined reference or a sensor indicated destination.

4.2 TERMINAL AREA NAVIGATION

This grouping of navigational functions includes all navigational involvement in the launch and recovery of the aircraft, and its navigation around the terminal area. This is the navigation phase performed between either the pre- and post flight phase and the enroute navigation phase. This group of navigational functions is further subdivided into the following subfunctions: Site Recognition, Close In Navigation, and Final Guidance. An additional navigational subdivision of the terminal area navigation function is objective area navigation. Objective area navigation includes those navigational functions associated with the performance of a mission at its terminal point. However, since it is mission oriented, it is included under the Tactical Operations navigation functions.

4.2.1 SITE RECOGNITION

Provides those navigation functions associated with the recognition of both civil and military and defined and indicated landing sites. When conventional type aircraft and landings are considered, this is a fairly rudimentary function. However, when vertical landings are considered, the extent of available sites expands quickly and therefore increases the problem and importance of site recognition.

4.2.2 CLOSE IN NAVIGATION

Provides the navigational functions associated within the immediate area of either a launch or recovery site. It is the transition phase between the enroute navigation and the final guidance navigation phases. For takeoffs, it is the phase during which procedures to position the aircraft at the desired altitude are employed. This phase is normally terminated when the aircraft reaches its desired cruise altitude at which time the enroute navigation phase begins. For landings, this phase is normally initiated when maneuvers to arrive at a marshall point are initiated. This is the phase when an aircraft engages in patterned flight at some designated location, awaiting a landing opportunity. The close in navigation phase for recovering is terminated and the final guidance phase begins when patterned flight at the marshall point ceases for IFR (Instrument Flight Rules) landings, or a descent for the "break" on VFR (Visual Flight Rules) landings. Additionally, the close in navigation requirements will differ according to whether the landing or recovery site is civilian or military, the type of site, weather conditions (category of visibility for landing), and the mode of aircraft landing or taking off (conventional or vertical).

4.2.3 FINAL GUIDANCE

Provides the navigational functions associated with either the launch or recovery of an aircraft. For launch, it is the phase between preflight initialization and close in navigation. The preflight phase is terminated when the aircraft propulsion power and all required systems are up; then the final guidance takeoff phase is entered. The final guidance takeoff phase is the phase during which an aircraft is transitioned from a position and condition which indicates flight readiness to being safely airborne. The final guidance takeoff phase is terminated when the aircraft is safely airborne; the close in navigation phase is then entered. For recovery, this is the phase between the close in navigation and post flight phases. The final guidance recovery phase can be further subdivided into a descent and landing phase. The descent phase is the phase during which an aircraft is flown IFR or VFR from the marshall point to visual sighting of a "meatball" in IFR approach or at the "break" in VFR approaches. This phase is terminated when the aircraft is flown by visual sightings on the meatball or the touchdown point at which the final guidance landing phase is entered. The landing phase is the phase during which an aircraft is maneuvered from an airborne visual sighting of the "meatball" or a touchdown point, to a designed servicing or maintenance area with engines stopped. This phase is terminated when the aircraft is at a complete stop, with engines stopped, in a servicing or maintenance area where the aircrew contemplates no further aircraft movement. Final guidance for V/STOL applications requires the development of systems or techniques which are at least an order of magnitude better in performance than present carrier systems.

Final guidance navigation functions will require provisions for supporting visual, aided and automatic launch and recovery. Additionally, the final guidance navigation requirements will differ according to whether the landing or recovery site is civilian or military, the type of site, weather conditions (category of visibility for landing), and the mode of aircraft launch or recovery (conventional or vertical).

4.3 FLIGHT CONTROL SUPPORT

The functions indicated under this heading relate to the functional support provided by the navigation systems and sensors to the aircraft's manual and automatic flight control system. The navigational functions and/or requirements differ according to the aircraft's four modes of flight (conventional, vertical, launch and recovery). A fifth distinct mode of aircraft flight maneuvering is highly mission oriented and as a result, is considered under the navigation tactical operations functions. Although similar navigational functions might be performed among the aircraft's modes of flight, they differ significantly as per accuracy requirements and rates to be distinct according to the mode of flight and the manner of flight control (manual or automatic).

4.3.1 CONVENTIONAL

In the conventional mode of flight, the V/STOL aircraft behaves as a conventional fixed wing aircraft (no vertical flight augmentation). In order to support this mode of flight, navigation data will be required to support the following flight control functions:

a. Stability Augmentation - This function provides damping of the aircraft's dynamic responses in roll, pitch and yaw to improve the pilot handling qualities of the aircraft. The extent of augmentation is dependent on the conditions of flight and the aircraft's characteristics.

b. Altitude and Heading Hold - This function provides orientational control of the aircraft to selected roll and pitch attitudes and heading.

c. Path Control - This function provides both lateral and vertical guidance of the aircraft.

d. Terrain Following - Provides the lateral and vertical navigation information required to follow a terrain.

4.3.2 VERTICAL

The vertical mode of flight involves to varying degrees, the augmentation of the conventional mode of flight by vertical aircraft operation. In order to support this mode of flight, navigation data will be required to support the following flight control functions:

a. Stability Augmentation - This function provides damping of the aircraft's dynamic responses in roll, pitch and yaw to improve the pilot handling qualities of the aircraft. The extent of augmentation is dependent on the condition of flight and the aircraft's characteristics.

b. Altitude and Heading Hold - This function provides orientational control of the aircraft to selected roll and pitch attitudes and heading.

c. Hover Augmentation - This function provides damping of the aircraft's dynamic response in the vertical to improve the pilot handling qualities of the aircraft. The extent of the augmentation is dependent on the condition of vertical flight and the aircraft's characteristics.

d. Station Keeping - This function provides the navigational information required when the aircraft is adhering to a preselected patterned flight.

4.3.3 LAUNCH

The launch mode of flight involves the phase during which an aircraft is transitioned from a position and condition which indicates flight readiness to being safely airborne. In order to support this mode of flight, navigation data will be required to support the following flight control functions:

a. Stability Augmentation - This function provides damping of the aircraft's dynamic responses in roll, pitch and yaw to improve the pilot handling qualities of the aircraft. The extent of augmentation is dependent on the conditions of flight and the aircraft's characteristics.

b. Altitude and Heading Hold - This function provides orientational control of the aircraft to selected roll and pitch attitudes and heading.

c. Lift Control - This function provides the navigational information required during the critical lift phases. Primarily, this involves altering the rate of navigational information provided under other navigational functions.

d. Airspeed Control - This function provides flight at constant or programmed airspeed.

4.3.4 RECOVERY

This is the mode of flight during which an aircraft is maneuvered from an airborne condition and sighting of a touchdown point to a designated servicing or maintenance area with engines stopped.

In order to support this mode of flight, navigation data will be required to support the following flight control functions:

a. Stability Augmentation - This function provides damping of the aircraft's dynamic responses in roll, pitch and yaw to improve the pilot handling qualities of the aircraft. The extent of augmentation is dependent on the condition of flight and the aircraft's characteristics.

b. Altitude and Heading Hold - This function provides orientational control of the aircraft to selected roll and pitch attitudes and heading.

c. Lift Control - This function provides the navigational information required during the critical lift phases. Primarily, this involves altering the rate of navigational information provided under other navigational functions.

d. Airspeed Control - This function provides flight at constant or programmed airspeed.

4.4 NAVIGATION SYSTEMS MANAGEMENT

This is the functional area concerned with the management of the navigation subsystem. In this case, the navigation subsystem is considered as a complete entity or system unto itself. The operational support provided by the navigation system to the individual navigation sensors is not considered in this functional area because it is mission and operational dependent, and is, therefore, more appropriately considered under general navigational support of the aircrafts' sensor systems. As a result, navigation sensor support is considered under the tactical operations functional area.

Therefore, based on the previously identified premises, the navigational systems management functional area can be further subdivided into the following functions: initialize, mode select, configuration control, recovery and hybridization. The intent of the navigation systems management functions is to perform the general navigation system and mission navigation supervision.

4.4.1 INITIALIZE

This function will perform the sequence initiation and data verification of the navigation system. It is concerned with the navigation equipment initialization and with the preparation of the entire system to perform its function. It will include the preflight and initial system checkout, system test, program load, and the insertion of mission oriented apriori information and alignment data.

4.4.2 MODE SELECT

This is the general functional category that performs the navigation mission oriented sequences and general navigation system management. It will coordinate the navigation system sensor operation so that they will not interfere with each other but rather supplement and allow for the smooth transition between sensors. This category will accept the routine in-flight monitoring functions performed under configuration control and execute subsystem checkout and control. The navigation system status will be periodically reported and factored in with the mission and tactical algorithms in order to select the proper mix of navigation sensors for each tactical situation.

4.4.3 CONFIGURATION CONTROL

This function monitors the status of the system, provides the status informa tion to the mode select functions, executes any changes to the system configuration as determined by the mode select function and formats for the navigation displays, reactive controls and warning indicators. This function will also maintain the navigation system data base in order to facilitate, if necessary, a navigation system recovery. If a partial navigation system failure occurs, it will allow for the graceful degradation of the navigation system and/or allow for the independent processing if a central processor failure should occur. As the navigation configuration controller, it will monitor system status, monitor equipment status, perform comparisons, and navigation equipment switching.

4.4.4 RECOVERY

The inflight system monitoring function will identify any fault and perform the necessary equipment switching for degraded mode operation. The functions under this category will support an equipment or entire system recovery if either a partial or full navigation system failure would occur. Additionally, it will provide any navigation functional support required by other platform subsystems if the recovery of their function should be required. It will establish alternatives and priorities of action in the event of a failure and execute the actual recovery.

4.4.5 HYBRIDIZATION

This function will allow for the optimal mixing, sensor data correlation, and support of the navigation system data within itself and in its support of the other aircraft systems. Whereas the other functions comprising this category are associated with both navigation equipment and data management, this function primarily involves data management. Kalman and other estimation and filtering techniques will be utilized primarily to accomplish this function.

4.5 SAFETY

The navigational functions in this category are those required to enhance the safety of the aircraft and its crew, and to support the crew in the event of an abandonment. The navigation functional support of safety can be further subdivided into the following categories: avoidance of terrain, weather, and collision, as well as aircraft abandonment support.

4.5.1 TERRAIN AVOIDANCE

The purpose of a terrain avoidance system is to display or inform the crew of any objects above a preselected horizontal clearance plane. The clearance plane is vertically referenced to the aircrafts altitude; that is, it is located at a selected distance vertically beneath the aircraft. In addition to supplying the required navigation information, considerations involving aircraft dynamics (i.e., how fast the aircraft can change its velocity vector and how fast it can climb), radar information rate and the like will be required. In general, navigation information and support will be required in determining the following quantities:

- Desired clearance between aircraft altitude and the terrain.
- Actual clearance between altitude and the terrain.
- Extent that the terrain protrudes above the clearance plane.
- Angle between horizontal reference and antenna boresight.

- Angle from boresight to the line of sight direction to the terrain at the slant range to the terrain point.

- Angular protrusion of the terrain through the clearance plane as seen from a point directly beneath the aricraft.

- Slant range to the terrain point.

4.5.2 Weather Avoidance

The purpose of the weather avoidance system is to inform the crew of any weather disturbance in the intended flight path of the aircraft which might affect the safety of the crew or the performance of its mission. This will involve the correlation of the current and forecasted weather with the navigational information regarding the aircraft's transit or terminal area navigation and the supporting of the weather radar modes of the airborne radars in its computation of the weather patterns and eventual display.

4.5.3 Collision Avoidance

Collision avoidance provides the capability of detecting collisions and preventing them. For collision prevention, the required equipment may perform one or more of the following functions:

a. Detection of all potentially dangerous aircraft in the surrounding airspace.

b. Evaluate the actual occurrance or miss distance of a collision hazard.

c. Determine the precise maneuver needed, if any.

d. Specify when the maneuver should be initiated in order to ensure safe clearance.

4.5.4 Abandonment

This function will provide the navigational information required in the event of the aircraft's abandonment. It will provide positional information in the pre and post abandonment phases to facilitate the research and rescue efforts, and attitude and velocity information to crew's ejection system.

4.6 TACTICAL OPERATIONS

Whereas the previous five navigation functions addressed the navigational functions required in all modern aircraft simply because it is an aircraft, the functions addressed under tactical operations are primarily mission oriented in that they represent a catalog of functions required to perform the intended mission of the aircraft. As a result, it is via this functional area that the navigational support to the other aircraft sensors and systems required in the performance of the aircraft's mission is provided. The tactical operations function can be further subdivided into the following categories: command and control, fire control, maneuvering, mission sensors, communication, and navigation.

4.6.1 Command and Control

This provides the navigational support required by the aircraft in its exercise of authority and direction over its assigned forces in the accomplishment of his mission. In this role, the aircraft acts as a controller or an AEW type aircraft. As a result, the navigation functions will be required to provide information on the controlling aircraft as well as on the platforms being controlled and any targets of interest. The three dimensional position, velocity and rate information will be utilized in the performance of the platform identification, vectoring, and control functions as well as in the tactical display and platform cross-correlation of the controlled area.

4.6.2 Fire Control

Under this category is included the navigational support provided to the aircraft's weapons control system. The navigation information will be utilized for the initial alignment and/or guidance of the weapon. The navigation functional support requirements will be dependent on whether the weapon is controlled organically from within the aircraft, handed off to another vehicle, or accepted from another vehicle. Additionally, the type of weapon utilized (ballistic or guided) and the intended target (static or dynamic) will also affect the navigation support requirements. In addition to providing rate, position, velocity and attitude information, the navigation system via its support of the aircraft's sensors, which, in turn, support fire control, will also functionally assist in the target localization and identification and weapons release functions.

4.6.3 Maneuvering

This is the navigation phase normally performed at the objective area or between the cruise-in and cruise-out phases of the enroute navigation function. The maneuvering or objective area navigation includes these navigation functions associated with the performance of a mission. It is in reality, a subphase of terminal area navigation but because of its strong interrelationship with the aircraft's mission, it is included under the tactical operation functional area.

The navigation system will be required to functionally support the following types of missions: anti-submarine warfare (defense of task force/convoy, open ocean search and barrier operations), amphibious operations (preassault, task force positioning, assault and delivery, and logistics support), strike and ground support (close air support, indirect air support and gunfire and missile direct and indirect support), patrol and surveillance, mining and mine countermeasures (mine laying, mine location and mapping, and mine neutralization) underway replenishment (refueling), task force air defense (air-to-air and surface-to-air, and airspace management), and search and rescue.

The navigation functions that will be required to support the above missions are as follows: terrain follow, rescue, reconnaissance, station keeping, penetration, rendezvous, ditching, marking and spotting, air drops, and patterns. The navigation functional requirements will differ depending on whether the mission will require transgressing land or water.

The specific type of navigation activities that will be required to support the above functions are as follows: maintain specified course globally and locally, maintain path through corridor, maintain formation, maneuver relative to other units, maintain surface and air units on common grid, maintain grid lock between Naval and ground forces, enter/exit from a grid, locate air/surface/underwater targets, attack air/surface/underwater targets and maintain the relationship between the relative grid and an absolute grid system.

4.6.4 Mission Sensors

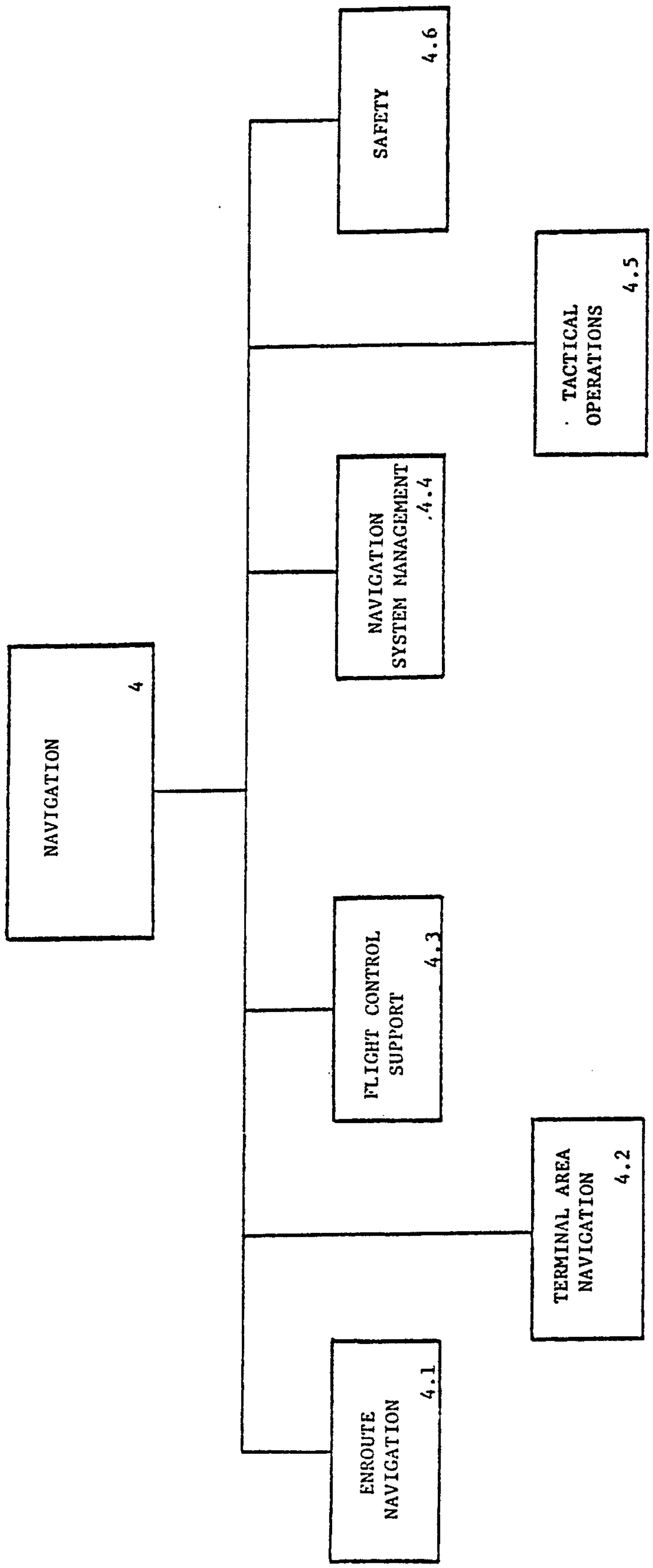
This function provides the required navigation support of the radar, electro-optical, ESM, acoustics, magnetic and photographic mission sensors. The navigation functional support will provide a stable platform, stabilize the sensor data, provide pointing information and periodically update and/or compensate the vehicle's state.

4.6.5 Communication

This function provides the required navigation support of the aircraft's communication system. The navigation functional support will provide pointing information, assist in the acquiring of the communication signals, and restrict the domain of communication search.

4.6.6 Navigation

Whereas the functional area concerned with the management of the navigation subsystem as an entity was considered in the Navigation System Management function area, the initialization, recovery, and augmentation of the individual navigation equipment is supported in this functional area. The navigation functional information will be utilized to start up and align the equipment, bound the error growth, resolve navigation ambiguities, stabilize the navigation sensors, and perform equipment compensation (damping and resets).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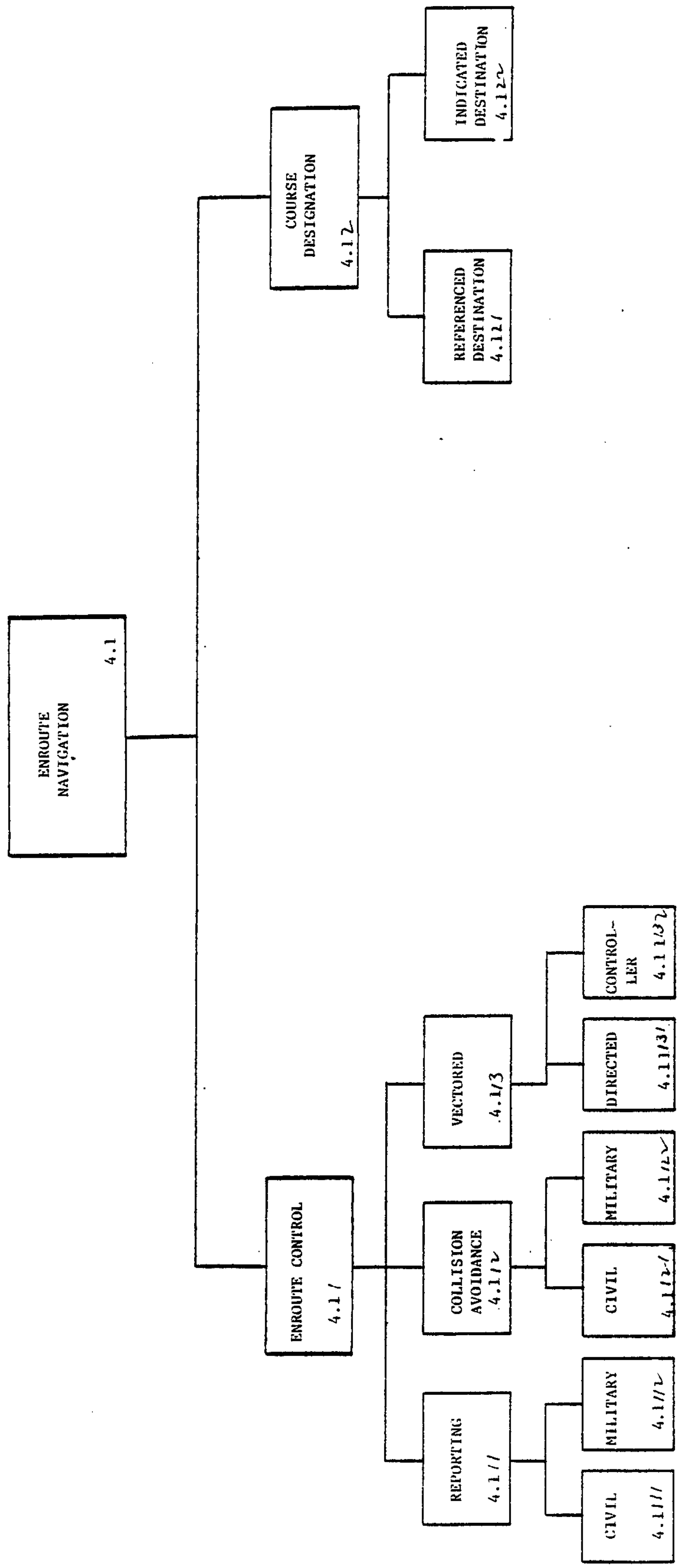
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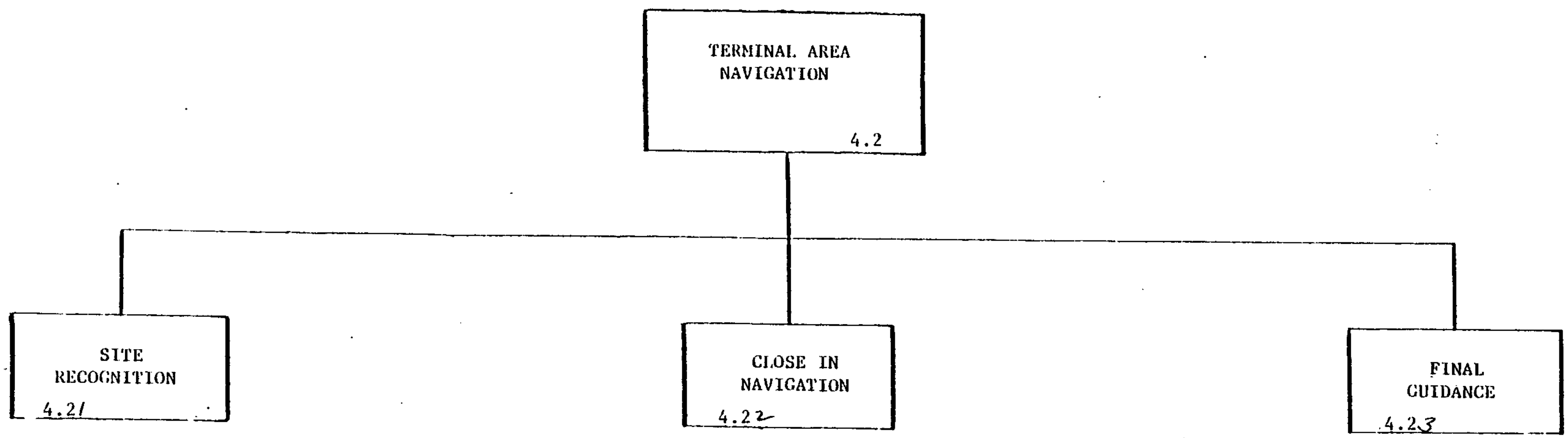
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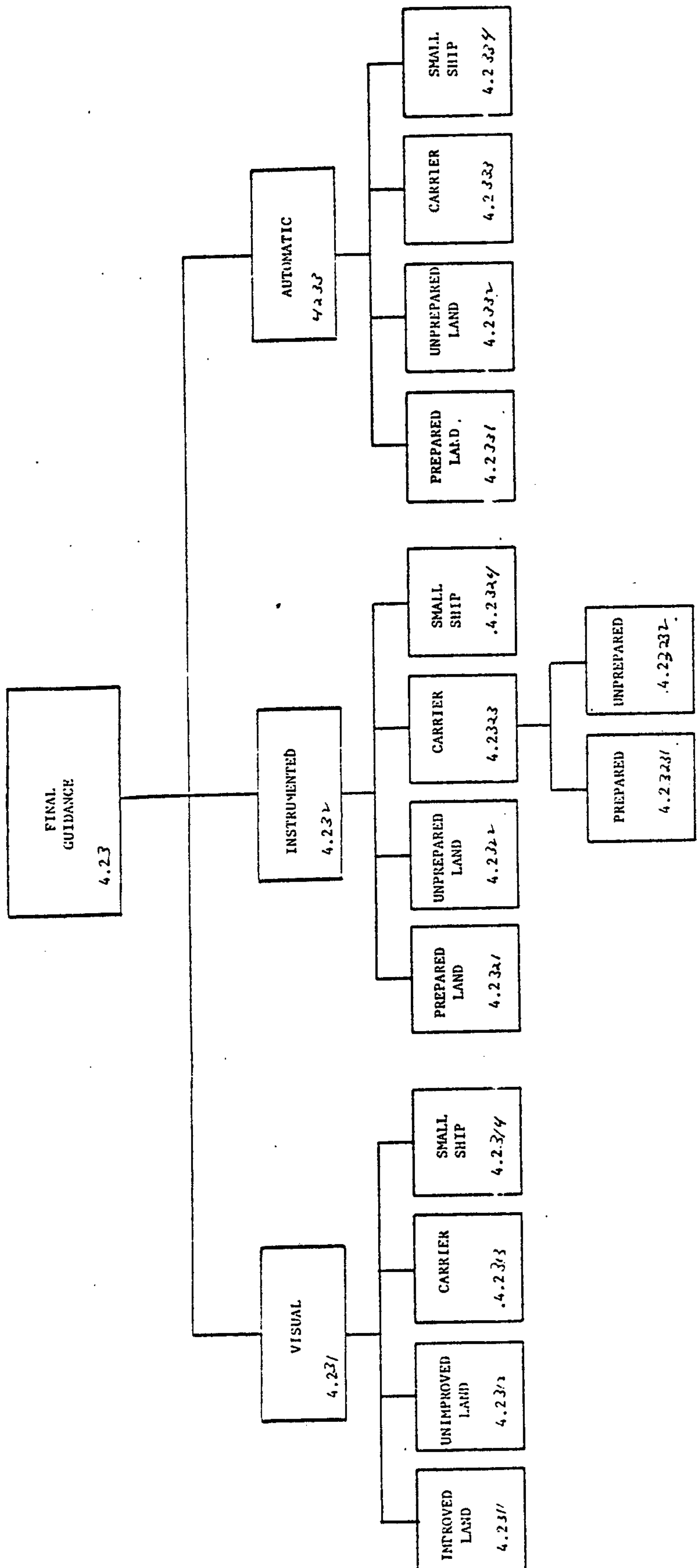
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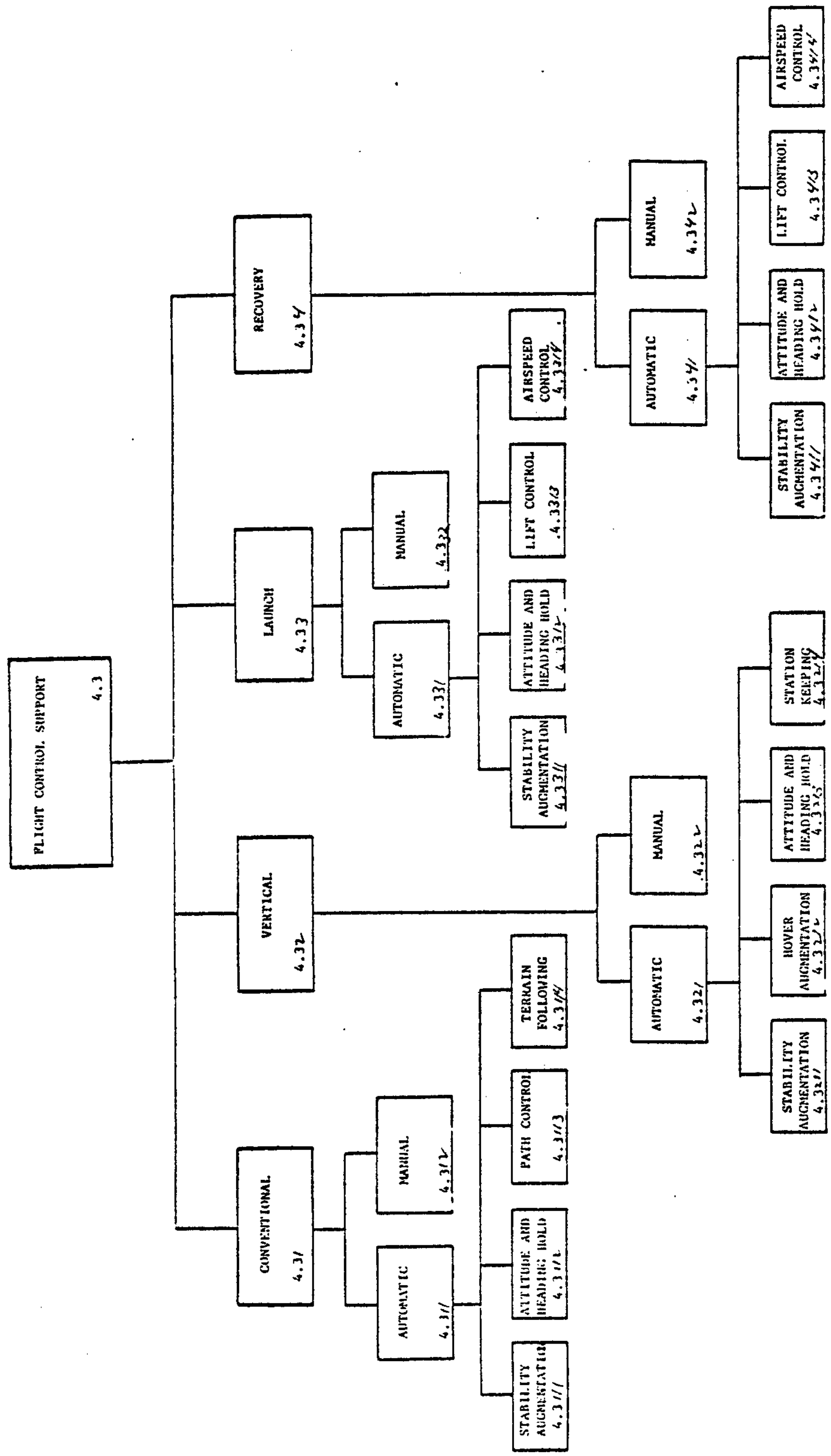
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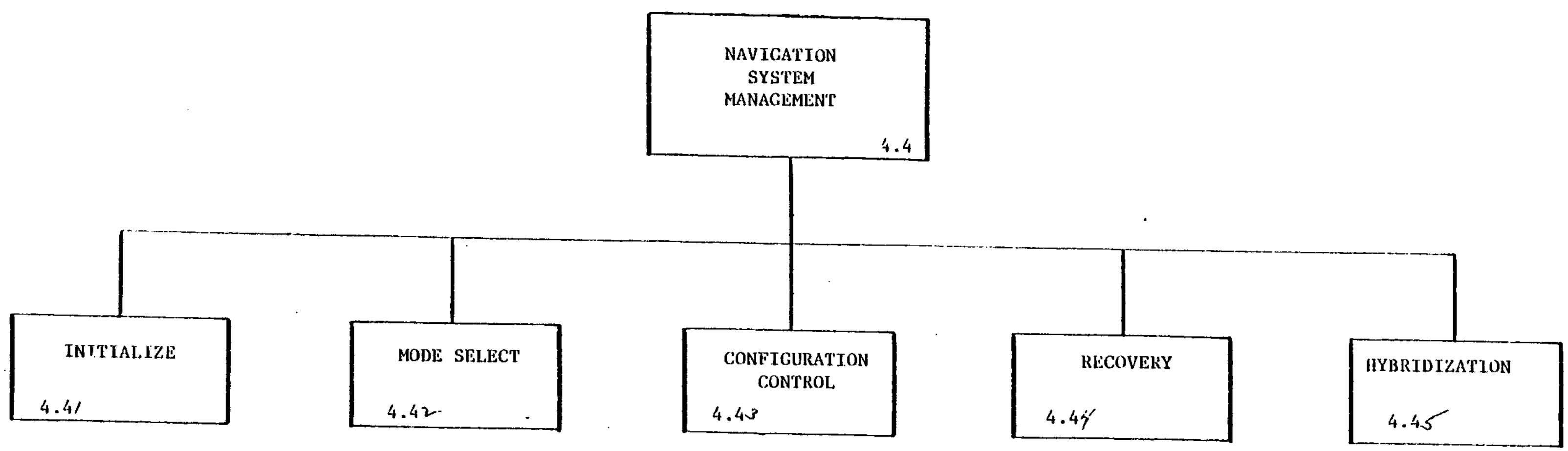
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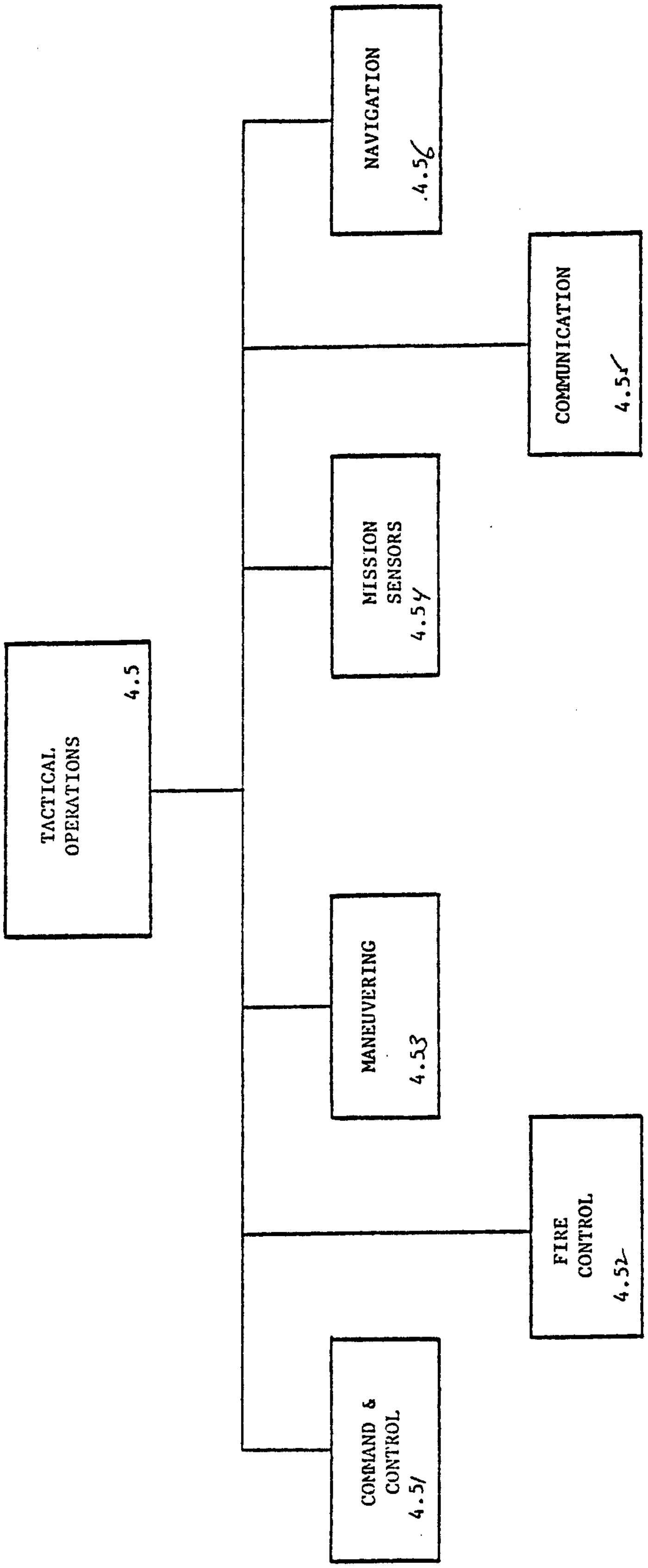
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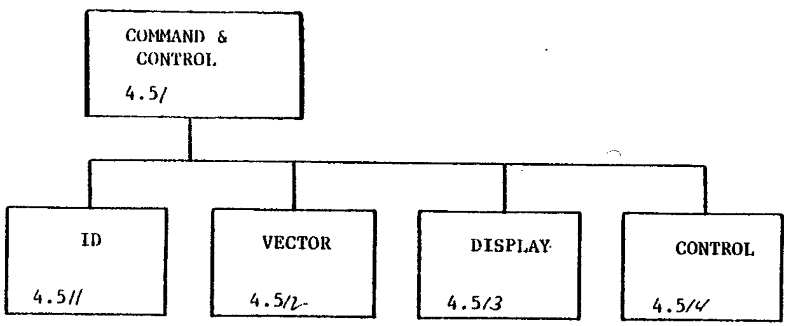
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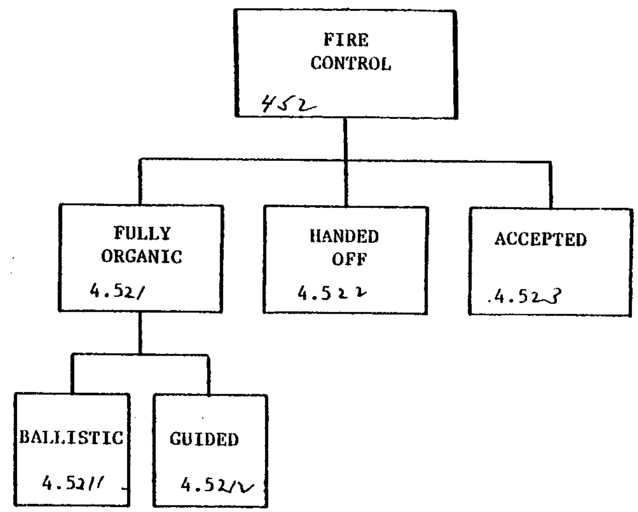
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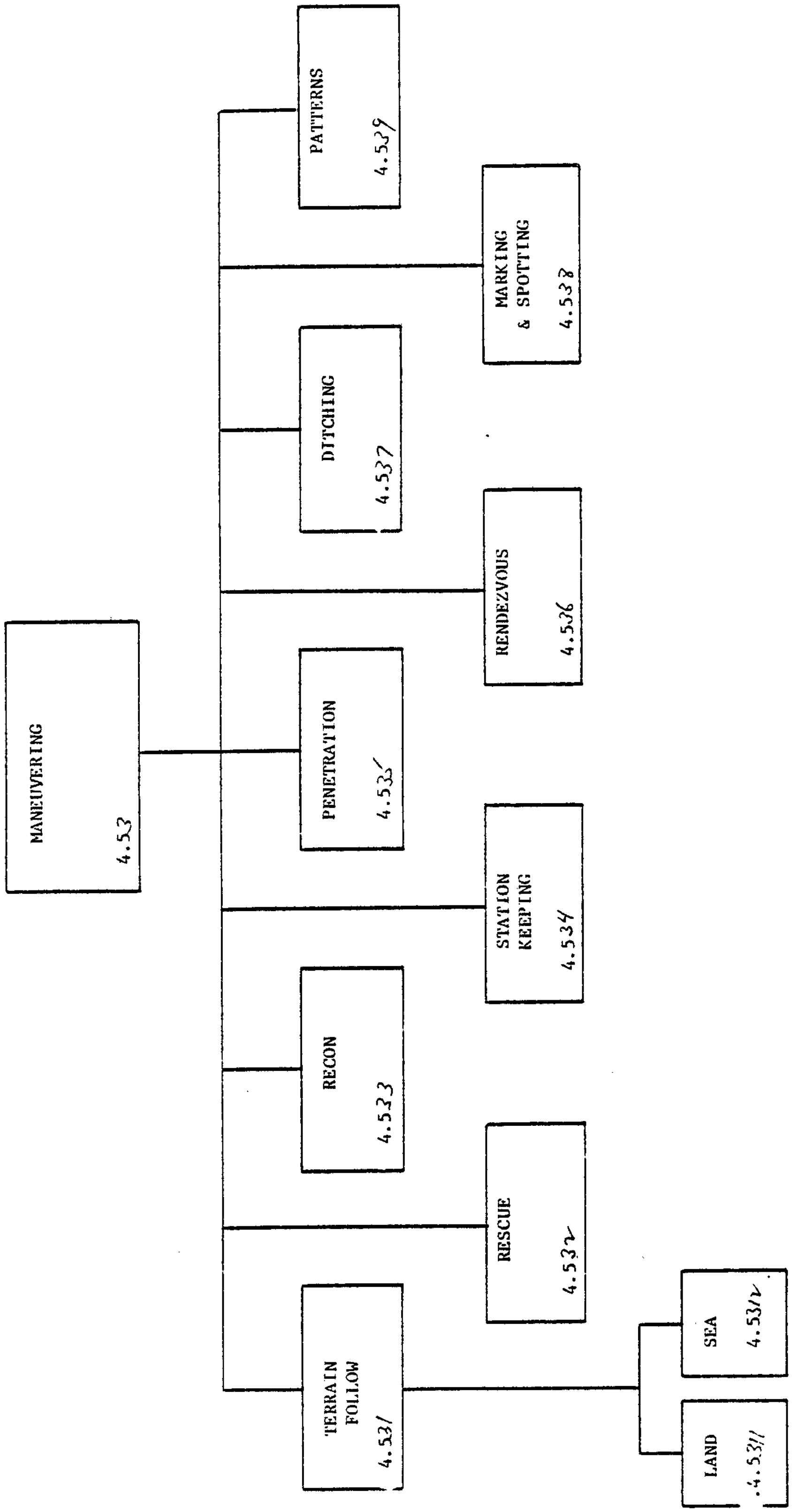

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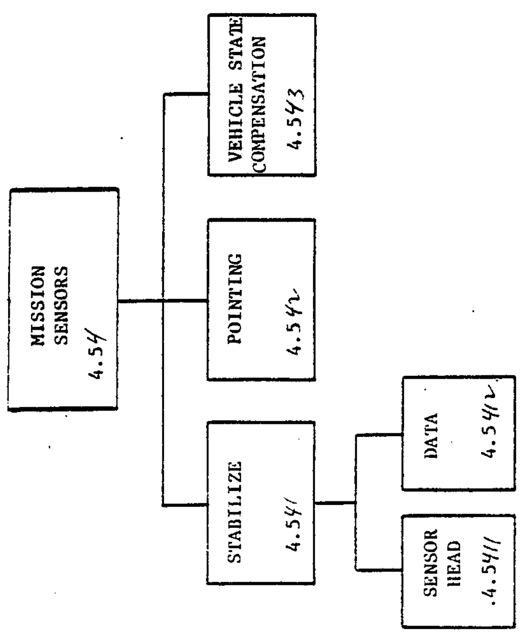
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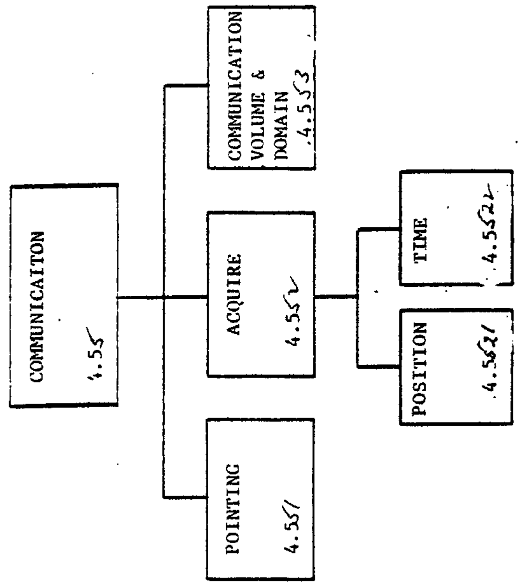
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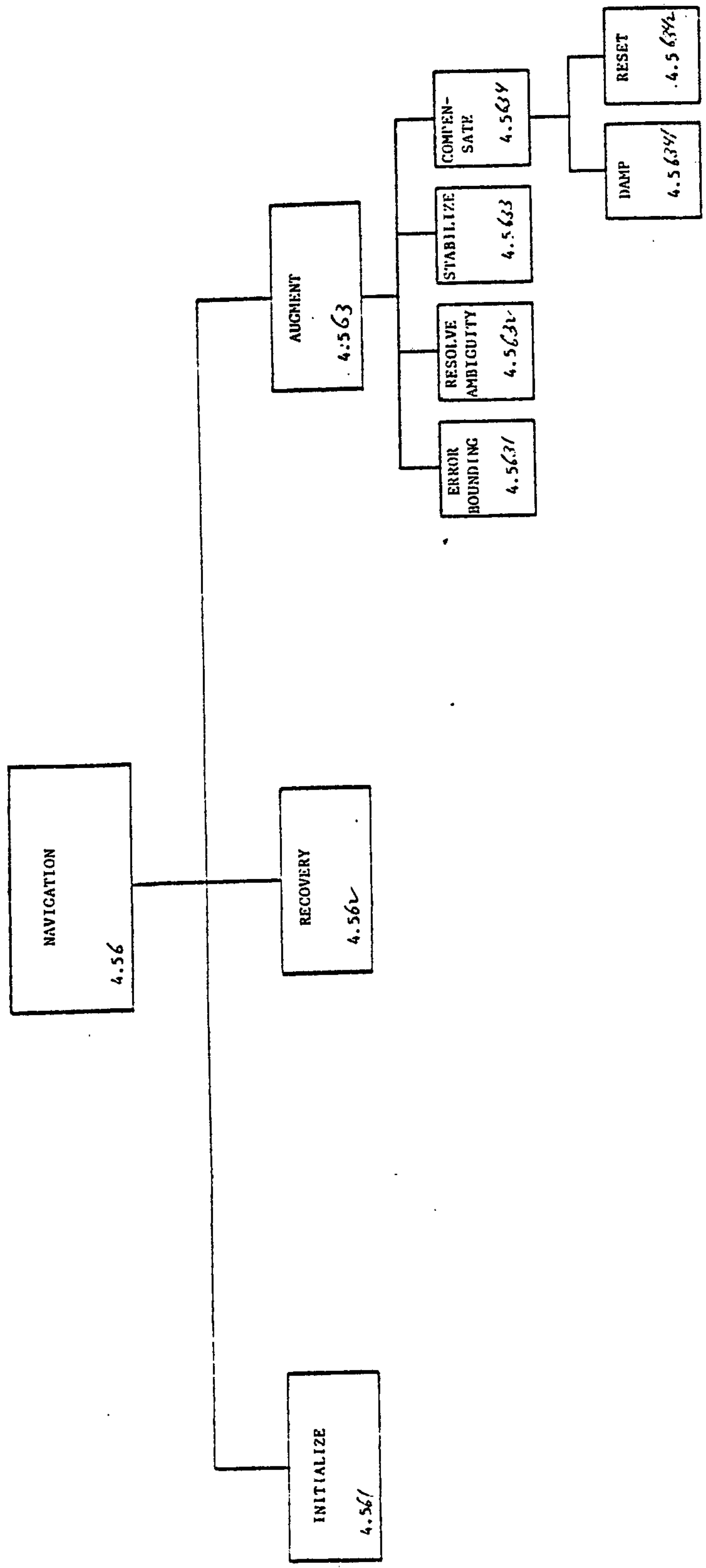
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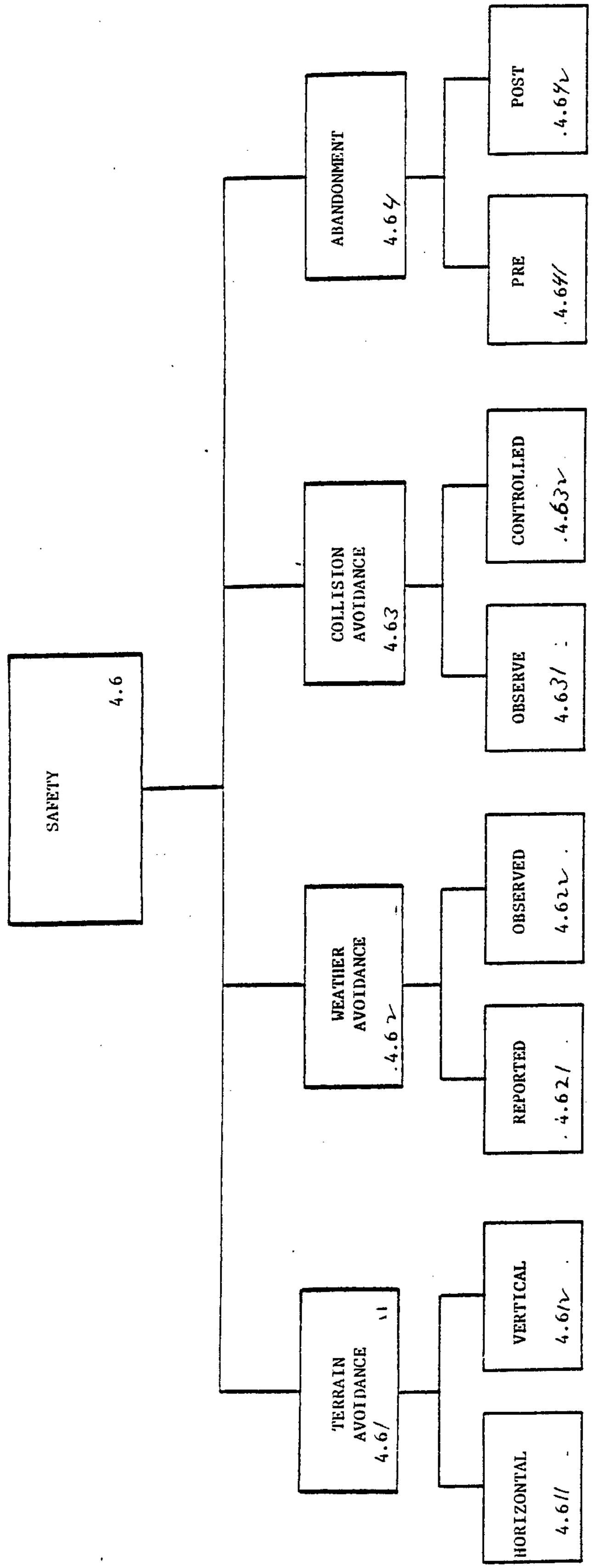
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5.0 COMMUNICATIONS

INTRODUCTION

The communications system for the V/STOL 'A' platform will provide for those functions which fall into the general categories of aircraft internal (intercom and equipment data exchange) and external (radio frequency) communications and control and management of the flow of data.

The tree diagrams outline a further partitioning of these categories into basic candidate functions which can be projected for V/STOL 'A' operations both for the AEW and ASW missions as well as Marine Assault and VOD operations.

The functions as outlined are based on existing E-2C and S-3A aircraft equipment complements (which satisfy associated communications functions) and projected functional capabilities as may be appropriate from existing V/STOL 'A' requirements documentation.

5.1 INTERNAL COMMUNICATIONS

Included within the internal communications functions are intra-crew and intra-system data exchange.

Intra-Crew

- Voice Intercom - Voice intercom addresses the requirements of providing for both 'clear' intra-crew communications and 'secure' crew-to-equipment (radio) exchange of information. Both of these functions may be in an analog or digital format depending on the actual aircraft equipment and technology utilized. For example, if voice recognition techniques are employed, the crew member's voice may be in a digital format before entering the ICS (Intercom System).

- Display Data - Display data considers that data which is required both by pilot and crew displays. In general, it addresses status, tactical, and BIT data which may be appropriate during a given portion of the flight. Incorporated within this type of data will be audio warning tones which may occur simultaneously with certain display data and the display of total aircraft performance data, i.e., flight control, electrical system, etc.

Intra-System

The Intra-System communications addresses those data among avionics system equipments which will be exchanged via an appropriate means of interconnectivity (party line multiplex bus structure and/or point-to-point wiring). These data will be in the form of both analog and digital, which will include the spectrum of digital discrete, slow and high rate digital data, acoustic, video, and radio system IF signals. These types of signals represent processed and unprocessed data as well as control and status.

5.2 EXTERNAL COMMUNICATIONS

There are three basic subsets of External Communications, namely:

- Line-of-Sight (LOS)
- Extended Line-of-Sight (ELOS)
- Beyond Line-of-Sight (BLOS)

The particular candidate functions which fall under the above three categories are as indicated in the tree diagrams. LOS communications would consider direct point-to-point exchange of information. Presently all LOS command and control and basic CNI is conducted within the UHF and Lx radio frequency bands. Mission specific VHF is utilized for ASW sonobuoy operations.

Extended LOS implies those types of operations which, because of radio horizon limitations within 100-300 n.m. ranges, require an airborne relay capability or the need for an HF channel.

Beyond LOS, 300 n.m. or greater, is defined as long haul communications requiring an HF or proposed satellite capability.

Present requirements indicate the need for a submarine to aircraft link and a total security capability for all data/voice transmissions. Additionally, jam resistance and low probability of intercept are indicated as requirements.

It is envisioned that these requirements coupled with the need for specific mission capabilities (acoustic and wideband links) will be balanced against V/STOL 'A' proposed Command and Control and specific mission scenarios and requirements documentation.

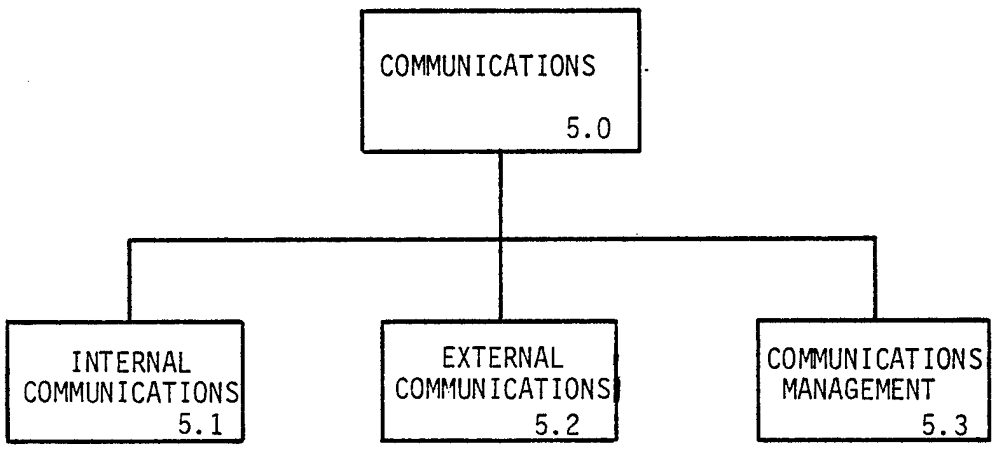
Additionally, the degree to which the communications system is integrated within the total avionics will impact which functions are classified as basic or common communications and which are considered as dedicated to a particular mission. As such, the communication system can be functionally partitioned such that maximum capability can be achieved with a minimum of equipment.

5.3 COMMUNICATION SYSTEM MANAGEMENT

Functional Description: The communications subsystem will be functionally initialized in a manner consistent with the system controller initialization (see Section 1.1). The mission data extraction, recovery and configuration functions will be as described in Sections 1.2, 1.3 and 1.5.

Inputs: Mission configuration data (channel allocations, mode and code assignments), data link messages, voice transmissions and manual entries.

Outputs: Control over V/STOL communications systems, verification of proper system operation and extraction of significant mission communication data.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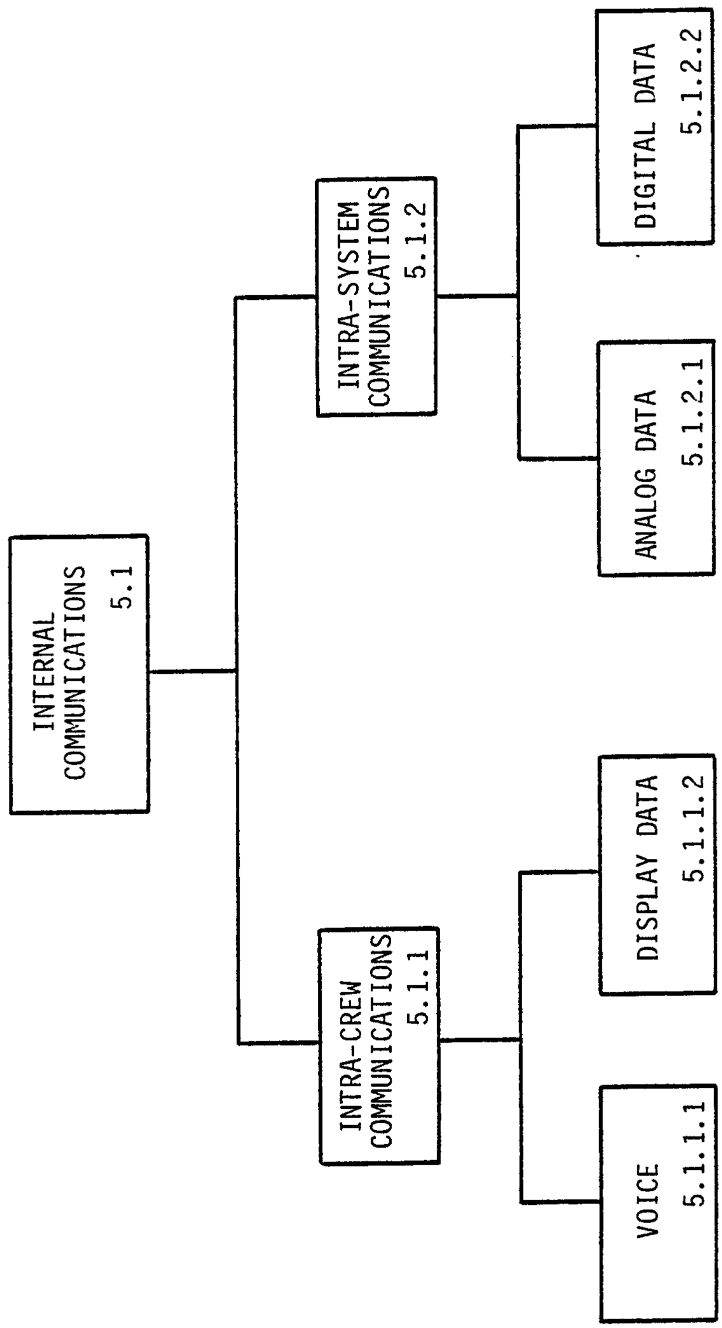
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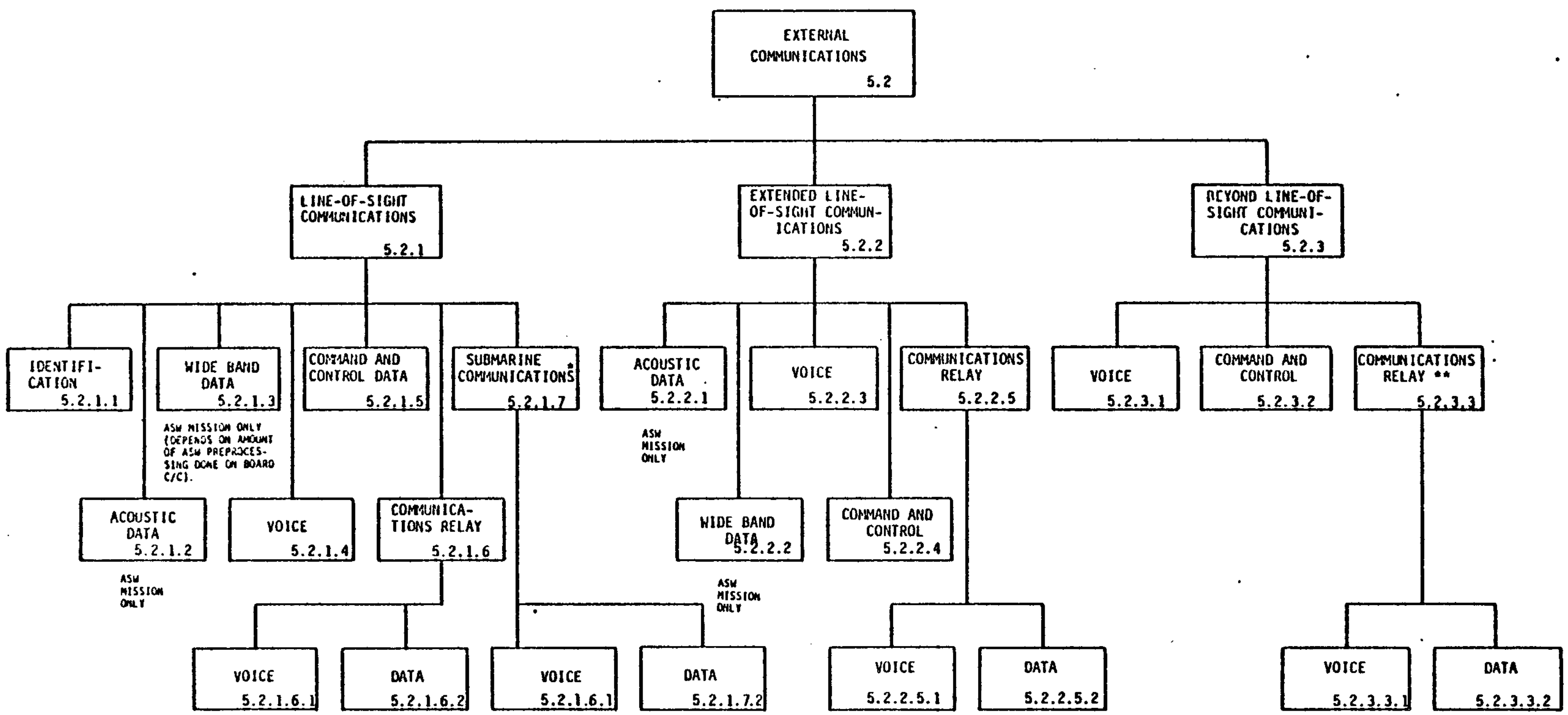
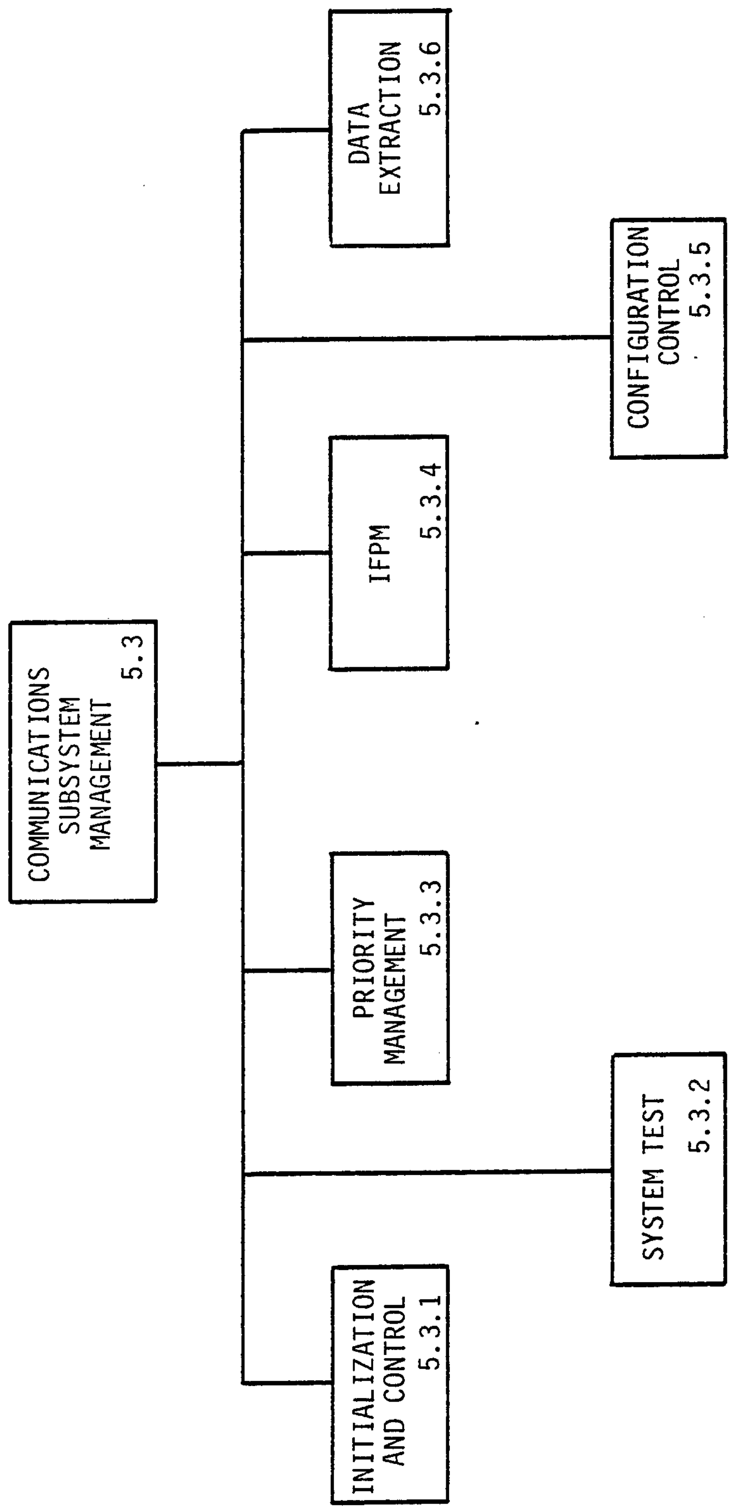


* Very Slow Rate of Info. Flow

** Satellite Communications

NOTE: All communications are clear/secure; jam resistant/LPI.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6.0 FLIGHT CONTROL SYSTEM MANAGEMENT AND CONTROL

6.1 RESPOND TO PRIMARY COMMANDS

Functional Description: The flight control system must respond to motion commands from the pilot and determine the proper input signals to the control surface and/or engine actuators to attain the desired aircraft motion. The motion commands include pitch, roll, yaw, airspeed, and, if the aircraft has vertical flight capability, altitude, attitude and heading. The flight control system uses air, inertial and navigation data and the feedback signals from the actuators to determine the necessary surface motions required to yield the desired aircraft motion.

Inputs: Pilot commands, sensor data, control surface position, speed, electric powers.

Outputs: Command signals to control surface actuators.

6.2 PROVIDE PILOT RELIEF

Functional Description: The flight control system must provide assistance to the pilot by performing many of the flight tasks automatically. This automatic control of flight path and other flight parameters will relieve pilot workload and improve mission effectiveness. The fundamental pilot relief modes are heading hold, altitude hold, attitude hold (both pitch and roll), airspeed hold (automatic throttle) and automatic landing.

Other pilot relief modes such as automatic navigation and automatic energy management (such as minimum time, and fuel, maximum range, maximum L/D (Lift/Drag) and maximum dynamic pressure flight paths), which are combinations of the fundamental modes, are provided by the flight control system to relieve the pilot.

The pilot will typically press a control button to command the flight control system to perform a selected mode. The flight control system must then continually monitor sensor inputs (motion, air data and navigation) and determine the proper command signals to the control surface actuators.

Inputs: Pilot mode select, sensor data, control surface position, speed, electric power.

Outputs: Command signals to control surface actuators.

6.3 PERFORM STABILIZATION

Functional Description: The flight control system provides continuous aircraft stabilization without any direction from the pilot. The major stabilization function of the flight control system for conventional flight is to damp out the motions created by turbulence. The stabilization function becomes even more significant in vertical landing conditions because of the proximity of the ship/land and the magnitude of the disturbances. Here, the flight control system must rapidly damp out the disturbed motion. In addition to turbulence, wind, thrust variation and ground effect phenomena affect the control of the aircraft.

In order to provide the stabilization function, flight control systems require angular rate, linear accelerations and air data to implement the inner loop stabilization laws.

The flight control system must provide the following stabilization modes: pitch, roll, yaw, speed and for vertical flight altitude, attitude, and heading.

Inputs: Sensor data (rates, accelerations, air), control surface position, speed, electric power.

Outputs: Command signals to control surface actuators.

6.4 TEST AND PROVIDE STATUS

Functional Description: The flight control system must provide for readiness testing to validate and/or troubleshoot the system and in-flight diagnostic testing to monitor system performance. Faults must be identified and reported to the pilot and to the reconfiguration section of the flight control system.

The readiness test must evaluate functional failures based upon failure modes and effects analysis and a hazard analysis which will identify all failures. Flight safety and mission critical failures and a random selection of faults should be induced in the equipment to verify that the in-flight monitoring schemes are capable of detecting faults to the desired levels.

The in-flight diagnostic test must monitor flight control system units, detect and isolate faulty units, and give status to the pilot on system operability.

Inputs: Test commands, aircraft status (speed, motion), electrical power.

Outputs: Cues and advisories to pilot, system status data and fault presence to display, commands to actuators for test.

6.5 MANAGE DATA

Functional Description: The flight control system must be initialized prior to aircraft takeoff. This initialization involves powering up the system and initiating the readiness test function. Other functions which must be performed within the flight control system are selection of flight mode conflict management, integration with other aircraft subsystem and reconfiguration.

Since the flight control system provides a flight critical function to the aircraft, a need for redundancy is inherent within the system. The redundant data must be compared and a voting must take place to select the proper signals if a conflict exists.

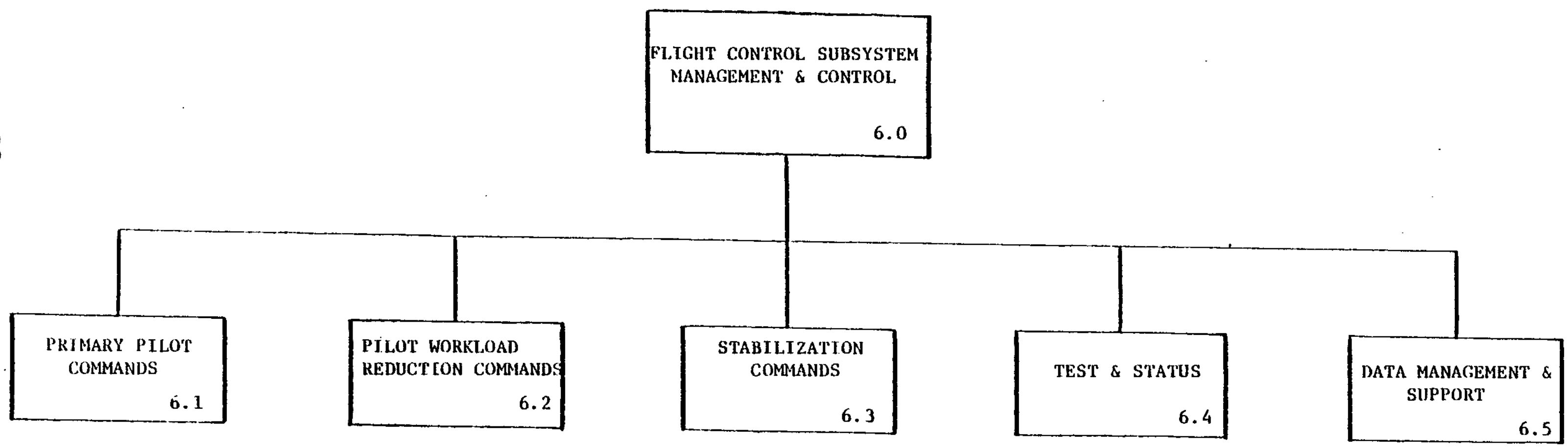
The flight control system must integrate with the following subsystems to perform its flight function:

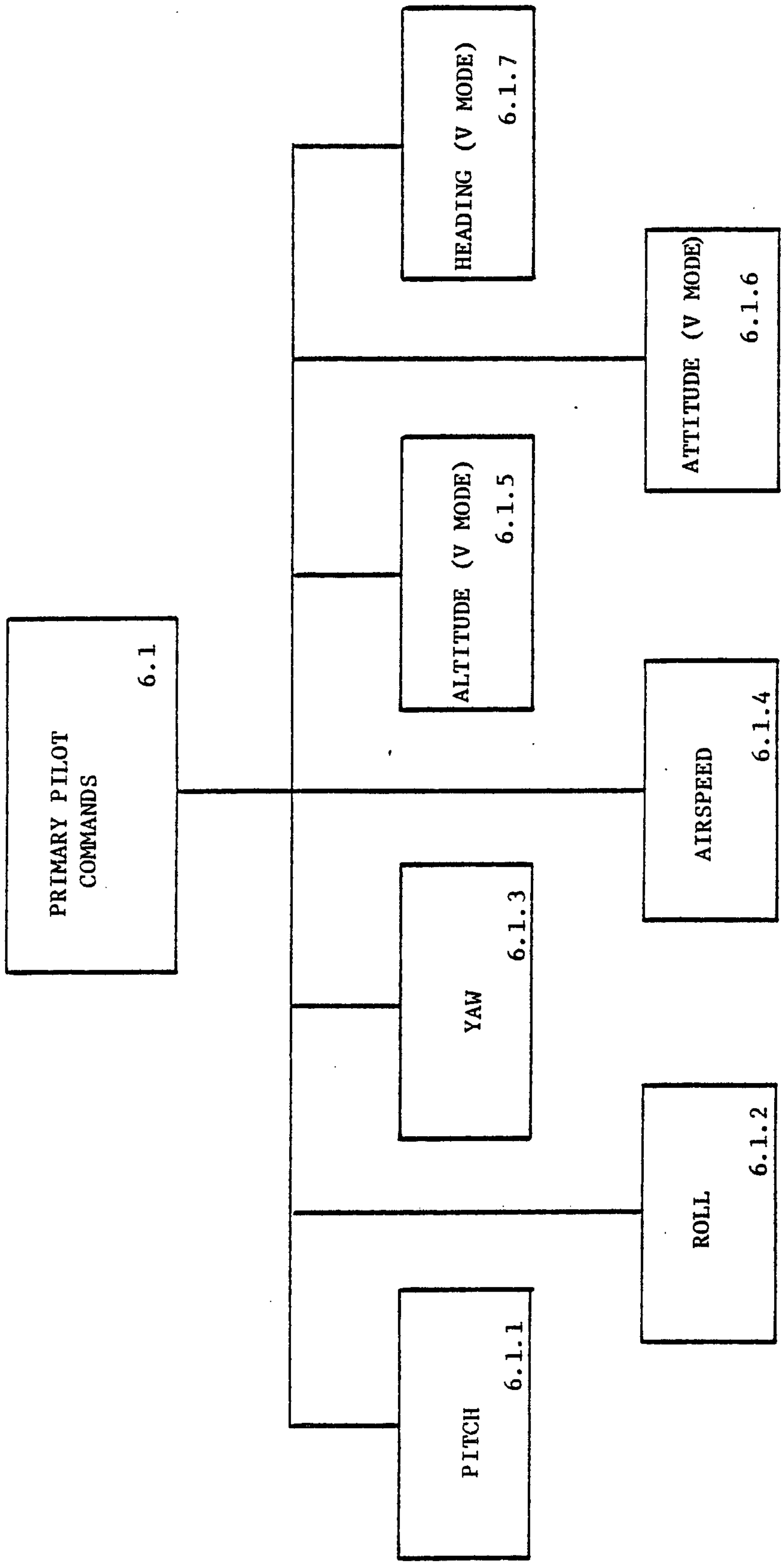
- Electrical - uninterrupted power
- Environmental Control - cooling
- Navigation - heading, guidance, sensing
- Display - subsystem information, pilot control
- Hydraulics - actuator power

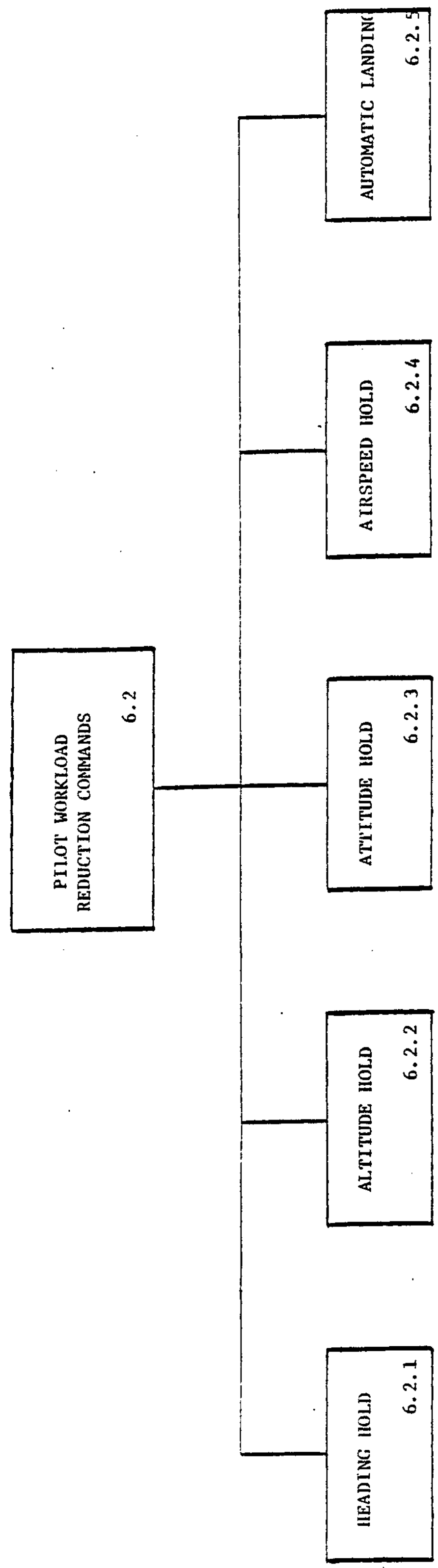
Upon determination and isolation of a fault, the flight control system must provide a reconfiguration capability in order to perform the mission goals (possibly with downgraded capability).

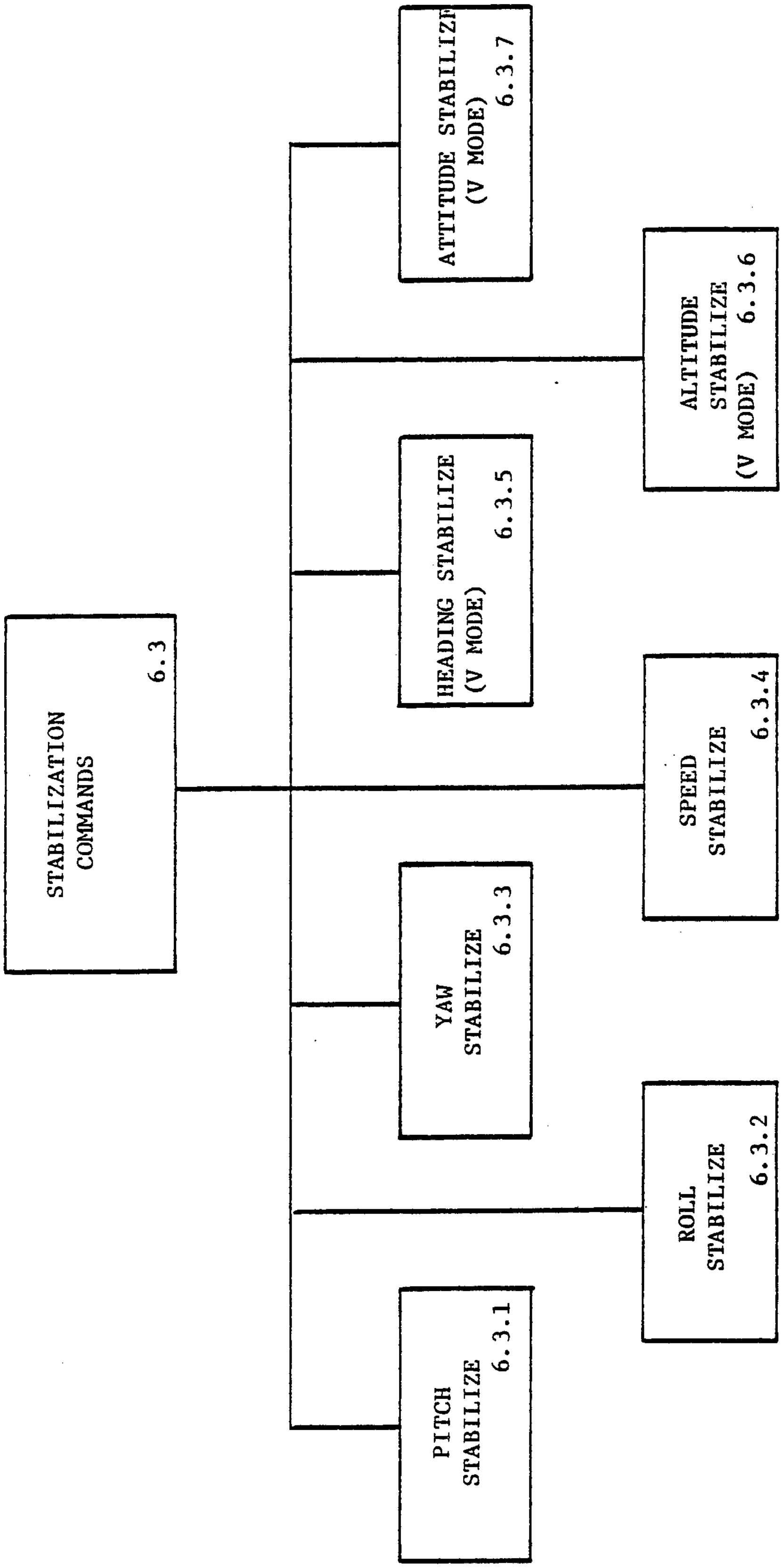
Inputs: Pilot mode select, electrical power, identified faults, sensor data.

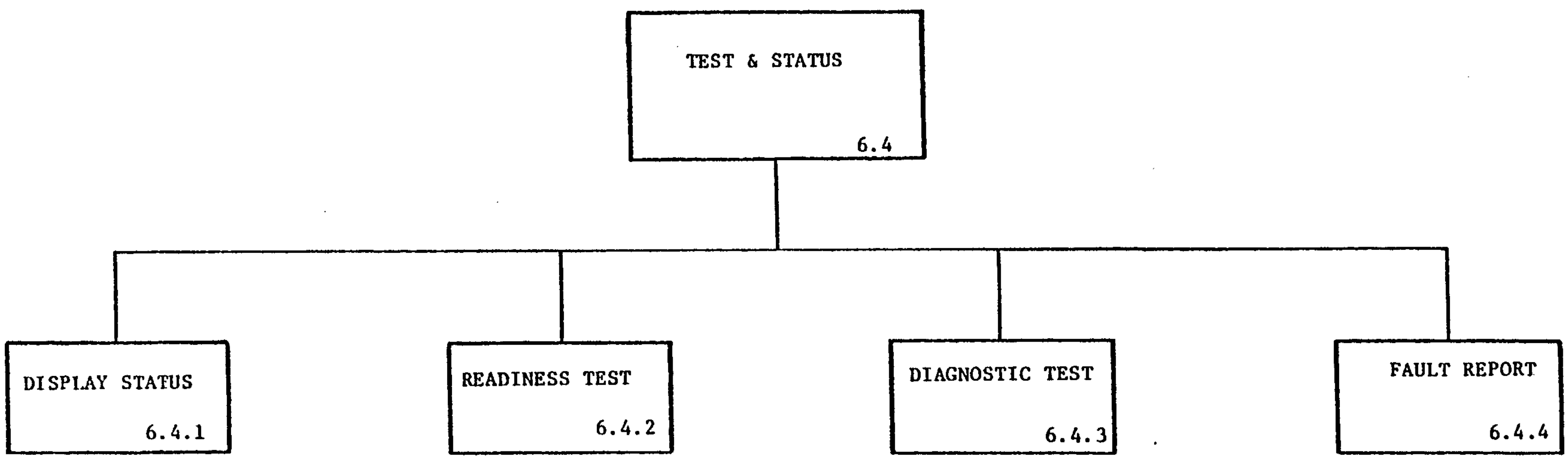
Outputs: System, status to display, request to subsystems commands for initialization.

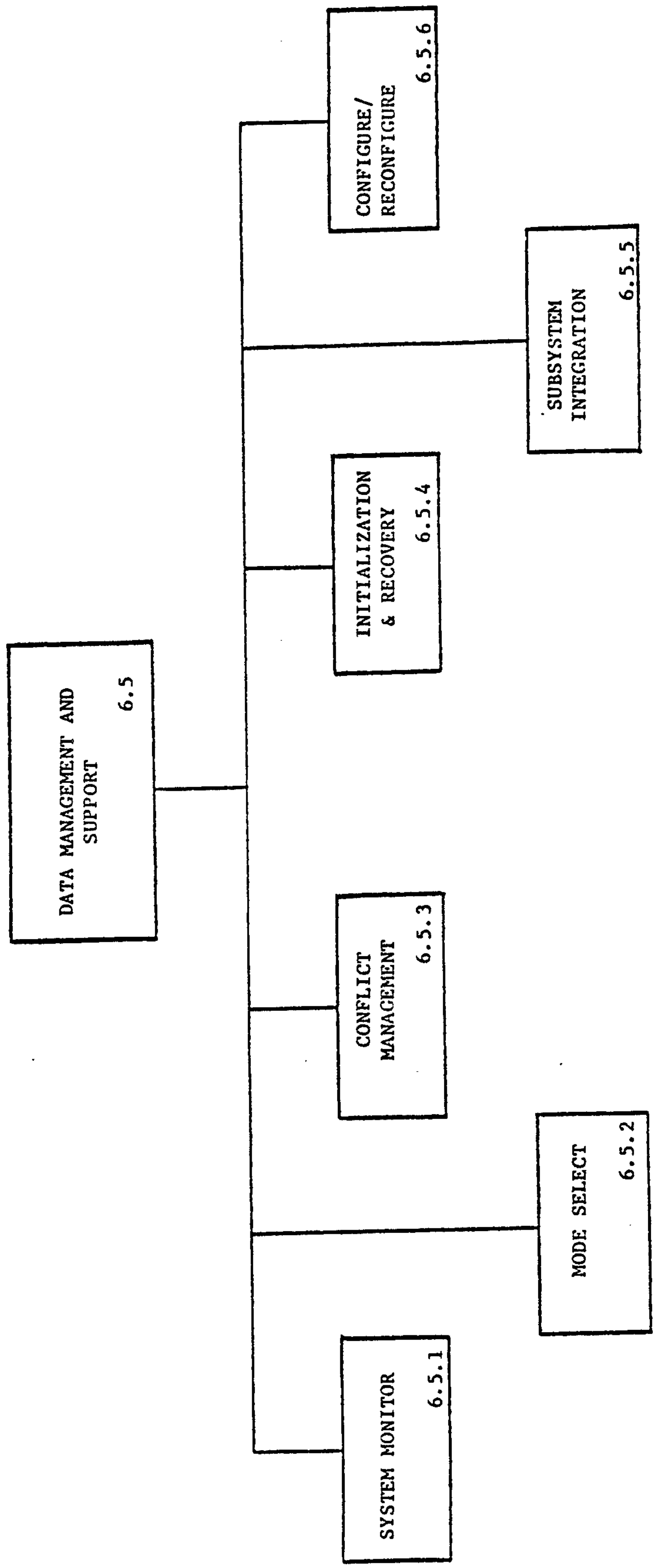

FLIGHT CONTROL SUBSYSTEM
MANAGEMENT & CONTROL
6.0
PRIMARY PILOT
COMMANDS
6.1
PILOT WORKLOAD
REDUCTION COMMANDS
6.2
STABILIZATION
COMMANDS
6.3
TEST & STATUS
6.4
DATA MANAGEMENT &
SUPPORT
6.5


PRIMARY PILOT COMMANDS
6.1
PITCH
6.1.1
ROLL
6.1.2
YAW
6.1.3
AIRSPEED
6.1.4
ALTITUDE (V MODE)
6.1.5
ATTITUDE (V MODE)
6.1.6
HEADING (V MODE)
6.1.7


PILOT WORKLOAD
REDUCTION COMMANDS
6.2
HEADING HOLD
6.2.1
ALTITUDE HOLD
6.2.2
ATTITUDE HOLD
6.2.3
AIRSPEED HOLD
6.2.4
AUTOMATIC LANDING
6.2.5


STABILIZATION COMMANDS 6.3
PITCH STABILIZE 6.3.1
ROLL STABILIZE 6.3.2
YAW STABILIZE 6.3.3
SPEED STABILIZE 6.3.4
HEADING STABILIZE (V MODE) 6.3.5
ALTITUDE STABILIZE (V MODE) 6.3.6
ATTITUDE STABILIZE (V MODE) 6.3.7


TEST & STATUS
6.4
DISPLAY STATUS
6.4.1
READINESS TEST
6.4.2
DIAGNOSTIC TEST
6.4.3
FAULT REPORT
6.4.4


DATA MANAGEMENT AND SUPPORT
6.5
SYSTEM MONITOR
6.5.1
MODE SELECT
6.5.2
CONFLICT MANAGEMENT
6.5.3
INITIALIZATION & RECOVERY
6.5.4
SUBSYSTEM INTEGRATION
6.5.5
CONFIGURE/ RECONFIGURE
6.5.6

7.0 SENSORS

Functional Description - The sensors aboard the V/STOL aircraft have the function of detecting, classifying, localizing and tracking subsurface, surface and air targets. The available sensors are either active or passive; and can be classifed as either electro-acoustic, electromagnetic or electrooptic. The AEW variant sensor complement includes ESM, surveillance radar and an electrooptic image detector. The ASW V/STOL variant has ESM, electro-acoustics, ASW radar, MAD and an electrooptic image detector and illuminator. All sensor related signal processing is done within the sensors subsystem.

7.1 SENSOR SYSTEM MANAGEMENT

Functional Description - The sensors subsystem will be functionally initialized in a manner consistent with the system controller initialization (see Section 1.1). This includes the execution of built in test and system test and the loading of operational software and apriori data. The mission data extraction, recovery and configuration functions will be as described in Sections 1.5, 1.2 and 1.3.

Inputs - Mission configuration control data (i.e., operating mode), manual control entries received via the display and control subsystem (i.e., turn-on of a sensor), and commands generated by the system controller.

Outputs - Control of the V/STOL sensors subsystem including: the reception of sensor data, signal processing and the resultant detection, classification, and localization outputs.

7.2 DETECT AND CLASSIFY

Functional Description - The detect and classify function involves the determination of the presence of a target (i.e., separation of targets from false returns or alarms) and the identification of the characteristics of that target which are of interest. In most cases, detection is made by observing a difference in a measurable electronic signal between the environment with no target present and the same environment with a target present. Sometimes the environment is characterized by the effects of sea, land, and/or weather while at other times the electronic noise generated by the sensing equipment constitutes the environment. Table V-1 lists some of the characteristics which are used currently or which have been proposed to perform the detect and classify function.

Inputs and Outputs - Table V-2 describes the interfaces that the sensor detect and classify function has with the other sensor functions as well as other aircraft functions.

Textual Description - There are three classes of sensors which can be used to perform the V/STOL 'A' detect and classify functions - acoustic, electro-magnetic, and electrooptic. Sensors from each class are being used for current AEW and ASW

Table IV-1. Characteristics Used to Perform Detect/Classify Function

Sensor Type	Sensor Mode	Detect	Classify
Acoustic	Active	Strength of acoustic return echo. Pattern of return on range/doppler display.	Pattern recognition of envelope of return.
	Passive	Strength of acoustic signal in narrow, specific frequency bands.	Specific frequency components of acoustic signal peculiar to the type of target.
Electro-Magnetic	Active (radar)	Strength of return signal processed to minimize effects of environment (clutter, jammer) and maximize signal.	Pattern recognition or image based on characteristics of particular target.
	Passive (MAD, ESM)	ESM: Strength of signal from external emitter.	Recognition of characteristics (PRF, pulse width, etc.) of emitter.
		MAD: Recognition of perturbation in earth's magnetic field caused by presence of magnetic object.	Pattern recognition of magnetic-field-strength waveform.
Electro-optic	Active (optical ranging)	Strength of reflected optical energy.	Pattern recognition of return signal.
	Passive (IR, Visual)	Strength of optical energy emitted by target or reflected from sun or other celestial bodies.	Image formed by scanning sensor across the target and sensing distributed energy.

Table IV-2. Inputs and Outputs

Subsystem	Function	Input from	Output to
1.0 System Processing	1.1 - Initialization	Initial control (parameter) settings.	Status of sensor system.
	1.2 - Recovery	Reset control settings.	Sensor system status after failure.
	1.4 - Tactical Mode Control	Sensor mode and parameter changes.	Sensor system status update.
	1.5 - Mission Recording		Sensor data.
	1.7 - Info. Correlation and Resolution		Sensor data
2.0 System Display and Control	2.1 - Display of System Data		Sensor data.
	2.4 - Display of Sensor Info.		Sensor data.
4.0 Navigation	4.5 - Mission Sensors	Aircraft attitude and heading. Aircraft ground track.	
7.0 Sensors	7.3 - Localize and Track		Sensor data.
	7.4 - Attack Support		Sensor data.
	7.5 - Navigation Support		Sensor data.
	7.6 - Safety		Sensor data.

functions. These sensors have been developed specifically to satisfy the needs of the fleet under present day doctrines. The emergence of new threats and a need for smaller more reliable sensor systems for V/STOL application dictates that a new look be taken at the sensor mix and performance. The cruise missile, for instance, constitutes a threat which is not satisfactorily countered by today's sensors. Improved radar and sonar capability and ESM sensitivity and bandwidth are straightforward ways to detect and classify these threats at operationally useful ranges. Other approaches which can be practical in certain scenarios are the use of sonobuoys to sense the engine noise of low flying missiles and the use of sensitive non-imaging IR systems to detect the high level radiation of missile rocket engines and exhaust gages at long ranges.

7.3 LOCALIZE AND TRACK

Functional Description - This function is executed after the detect and classify function has been completed. Localization is the fine fixing of a target position either in absolute geographic terms or relative terms. Localization is within one or a few target lengths. Tracking is the fine fixing of a target as a function of time including determination of heading and velocity both past history and projected. All target types subsurface, surface and air must be localized and tracked.

Acoustic, electro-magnetic and electrooptical passive sensors provide line of bearing on target emissions and event correlation of transient emissions. Active sensors provide range, line of bearing, heading and velocity. Tracks are generated by multiple localizations and suitable projection algorithms.

Inputs and Outputs - Table V-3 describes the sensor localize and track functions interfaces.

Textual Description - Traditionally, subsurface localization and tracking have been conducted at low aircraft altitude. After detection and classification by sonar, localization, and tracking are done by active sonobuoys, MAD and periscope detection radar. Electrooptical sensors would be used in a similar manner. With improved sonobuoy processing systems and improved navigation, it may be possible to localize and track a subsurface target from high altitude by dropping additional directional sonobuoys in the area where detections have been made. Improved sonobuoy location system would be a necessity. Possibilities exist from hunter killer concepts. If tracking is good enough, a single low level pass for attack could be used, decreasing aircraft vulnerability. These improved systems may eliminate the need for MAD and electrooptical sensors.

Additionally, low level aircraft and missiles along with high level supersonic aircraft and missiles may be tracked via sonar because of the high sound levels and high doppler rates and via IR because of high temperature engines and exhaust.

7.4 ATTACK SUPPORT

Functional Description - This function is executed after localization and tracking functions. Sensor attack support is the information on target position necessary to put the aircraft or supporting attack platform in proper attack position and for weapon guidance to the target. Sensor target position fixing must be well within weapon acquisition range. Position error should be approximately within the target size.

Table IV-3. Inputs and Outputs

Subsystem	Function	Inputs from	Outputs to
External to aircraft		Intelligence - threats in area, characteristics of threats, targets held by other platforms (source - TSC or other platforms). Sonobuoys operating RF channels and location (source-TSC other aircraft VS and VP).	Mission sensor tapes (TSC).
1.0	1.1 - Initialization		Target no., position, heading, velocity, characteristics, confidence (3.1), (3.2), (3.8) target track history and projected (3.1), (3.2).
2.0 System Display and Control	2.4 - Mode Select	Sensor and sensor processor modes.	
4.0 Navigation	4.5 - Tactical Operations	Aircraft location.	
5.0 Communications		Sonobuoy locations and channel numbers. Sonobuoy data.	
External to Function	Sensor tests mode selection detect and classify	Test signals, mode signals, detections and classifications of targets (confidence, characteristics, rough position, sensor data).	Sensor status, target position, heading, velocity, projected track, confidence in position, confidence in track sensor recording.

Attack support should provide status of target defenses via ESM (fire contrc radar function, missile doors open, radar, sonar pulse mode, missile launch, targ operating in degraded mode/damaged). Attack support should also provide strike assessment information (weapon detonation, air target water/ground impact, ship dead in water or sunk, target radar out of action, oil slick or debris on surface Attack support is required for all target types subsurface, and air. Sensors als provide weapons guidance such as target illumination and beam ride.

Inputs and outputs - Table V-4 describes the interfaces that the sensor atta support function has with the other sensor functions as well as other aircraft functions.

Textual Description - Sensor support of an attack is to provide target positi heading and velocity to systems processing, systems display control, plus other pl forms for as long a range from the target as possible. Various types of sensors acoustic, electromagnetic and electrooptical can be used. Possibility of passive covert sensor attack support will be included.

7.5 NAVIGATION SUPPORT

Functional Description - The navigation support function consists of providin information as to the position of the aircraft relative to features which are external to the aircraft (e.g., land masses, light houses, weather cells, deployed objects). This, in turn, can then be used in conjunction with other navigation ser sors. Table V-5 lists some of the characteristics which are currently used or are proposed to perform the navigation support function.

Input and Output - Table V-6 describes the interfaces that the sensor navigation support function has with the other sensor functions as well as other aircraft functions.

Textual Description - The three classes of sensors - acoustic, electromagnetic sensors such as radar and ESM can be utilized to determine the location of navigation features or weather cells based on radar paints or emissions from them. Electro-optics are useful in pin-point, close-in navigation in inclement weather or at night.

7.6 SAFETY

Functional Description - The sensors can contribute to the overall safety function by detecting the presence of danger or by aiding in the location of and communication with other parties which are in distress. Table V-7 lists some of the characteristics of sensors which contribute to the safety function.

Inputs and Outputs - Table V-8 describes the interfaces that the sensor safety support function has with other sensor functions as well as other aircraft functions

Textual Description - The contribution of the sensor safety function to the overall safety function of the aircraft is in the areas of avoidance of collisions with other aircraft and the ground and in localization and communication with distressed parties. All of the sensors can contribute to these functions.

Table IV-4. Inputs and Outputs

Subsystem	Function	Input from	Output to
External to Aircraft		Intelligence - what is the expected threat (TSC).	Target data to other platforms.
		Localization and Track from other platforms.	
1.0 System Processing	1.1 - Initialization		Threat data position, velocity, heading, depth/height, characteristics (radar, IR, sonar) (1.0), (2.0), (5.0), (9.0)
2.0 System Display and Control	2.4 - Mode Select	Sensor and sensor processor modes.	Strike assessment (1.0), (2.0)
4.0 Navigation	4.5 - Tactical Operation	Aircraft location.	
5.0 Communication		Sonobuoy locations and channel numbers. Sonobuoy data.	
External to Function	Localize and Track	Targets, position, tracks, headings, velocities, depth, height characteristics.	
	Sensor test Mode selection	Sensor data.	

Table IV-5. Sensor/Mode/Function

Sensor Type	Sensor Mode	Function
Acoustic	Active	Range and bearing to submergent objects (land masses, shoals, wrecks).
	Passive	Bearing to submergent acoustic emitters (location of objects, areas for mine laying).
Electro-magnetic	Active	Range and bearing to airborne and surface features (weather cells, land masses, ships).
	Passive	Bearing to other electromagnetic radiators (beacons, radars).
Electro-optics	Active	Range and bearing to airborne and surface features (weather cells, retroreflectors).
	Passive	Bearing to heat or light sources (cities, ships, light houses).

Table IV-6. Sensor Navigation Support Function Interfaces

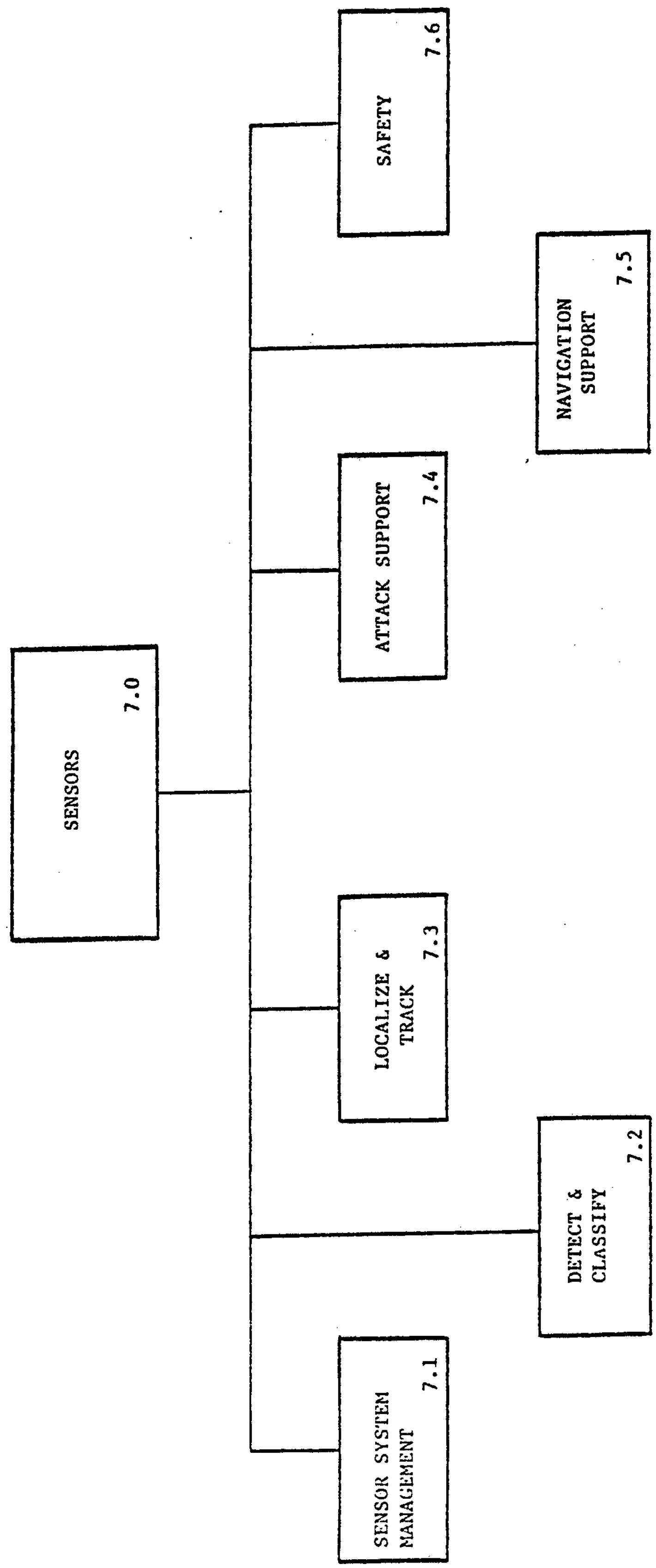
Subsystem	Function	Input from	Output to
1.0 System Processing	1.1 - Initialization	Initial control (parameter settings).	Sensor system status.
	1.2 - Recovery	Reset control settings which existed before failure.	Sensor system status.
	1.4 - Tactical Mode Control	Sensor mode and parametric changes.	Sensor system status update.
	1.5 - Mission Recording		Sensor data.
	1.7 - Information Correlation and Resolution		Sensor data.
2.0 System Display and Control	2.1 - Display of System Data		Sensor data.
	2.2 - Display of Sensor Information		Sensor data.
4.0 Navigation	4.5 - Mission Sensors	Aircraft attitude and headings, aircraft ground track.	
7.0 Sensors	7.6 - Safety	Potential hazard areas.	Hazard position.

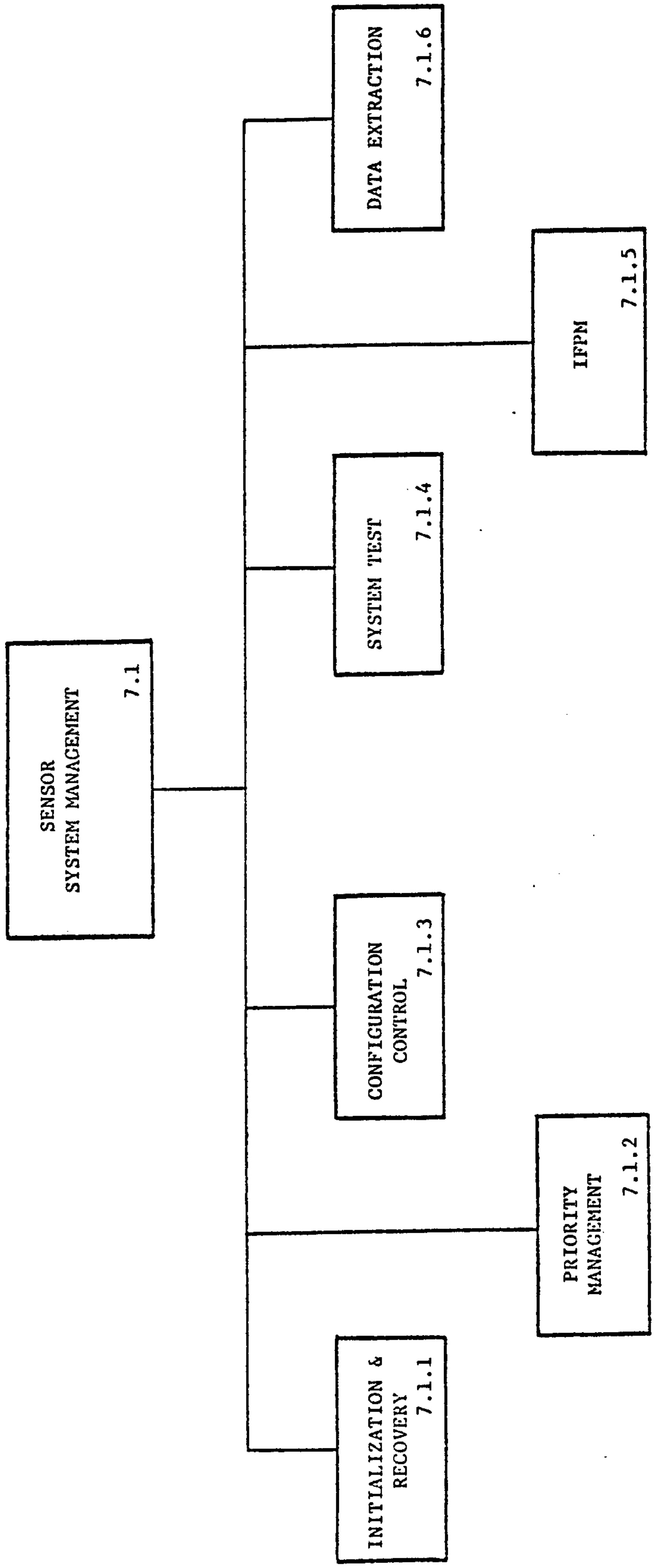
Table IV-7. Sensor Safety Functions

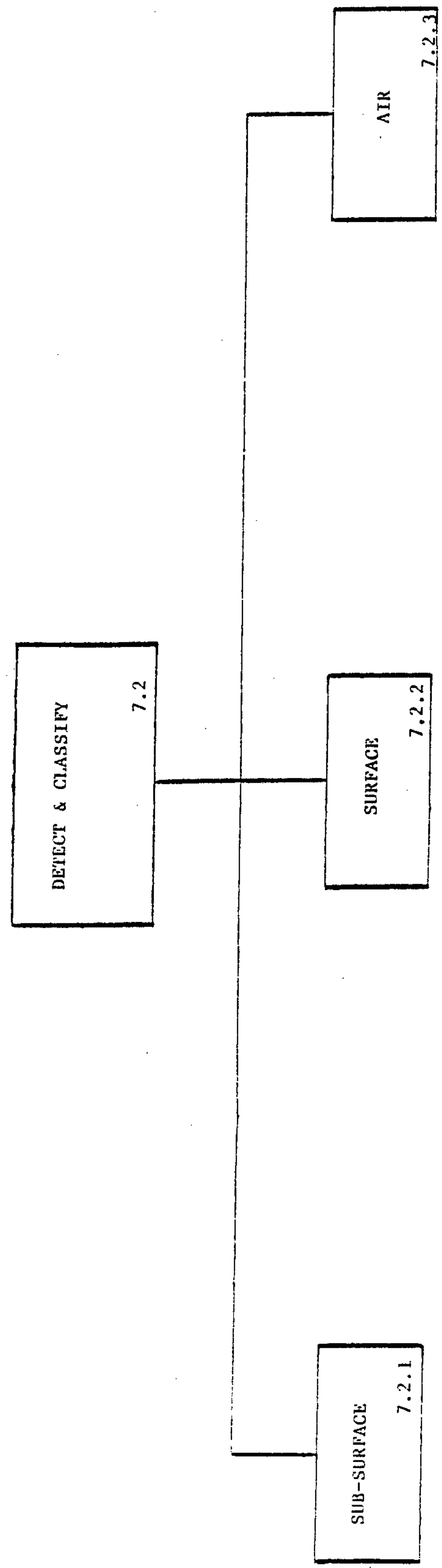
Sensor Type	Sensor Mode	Function
Acoustic	Active	Communication with underwater parties in distress.
	Passive	Reception of distress signals in water
Electro-magnetic	Active	Collision avoidance with air and surface targets. Communication with parties in distress (radar retroreflector, pulse detection). Collision avoidance by measuring rate of change of signal strength. Reception of communications via ESM receiver.
Electro-optic	Active	Subsurface communication and location. Collision avoidance with air and surface objects.
	Passive	Collision avoidance by measuring heat intensity. Reception of optical communications signals. Identification of distressed parties through imaging.

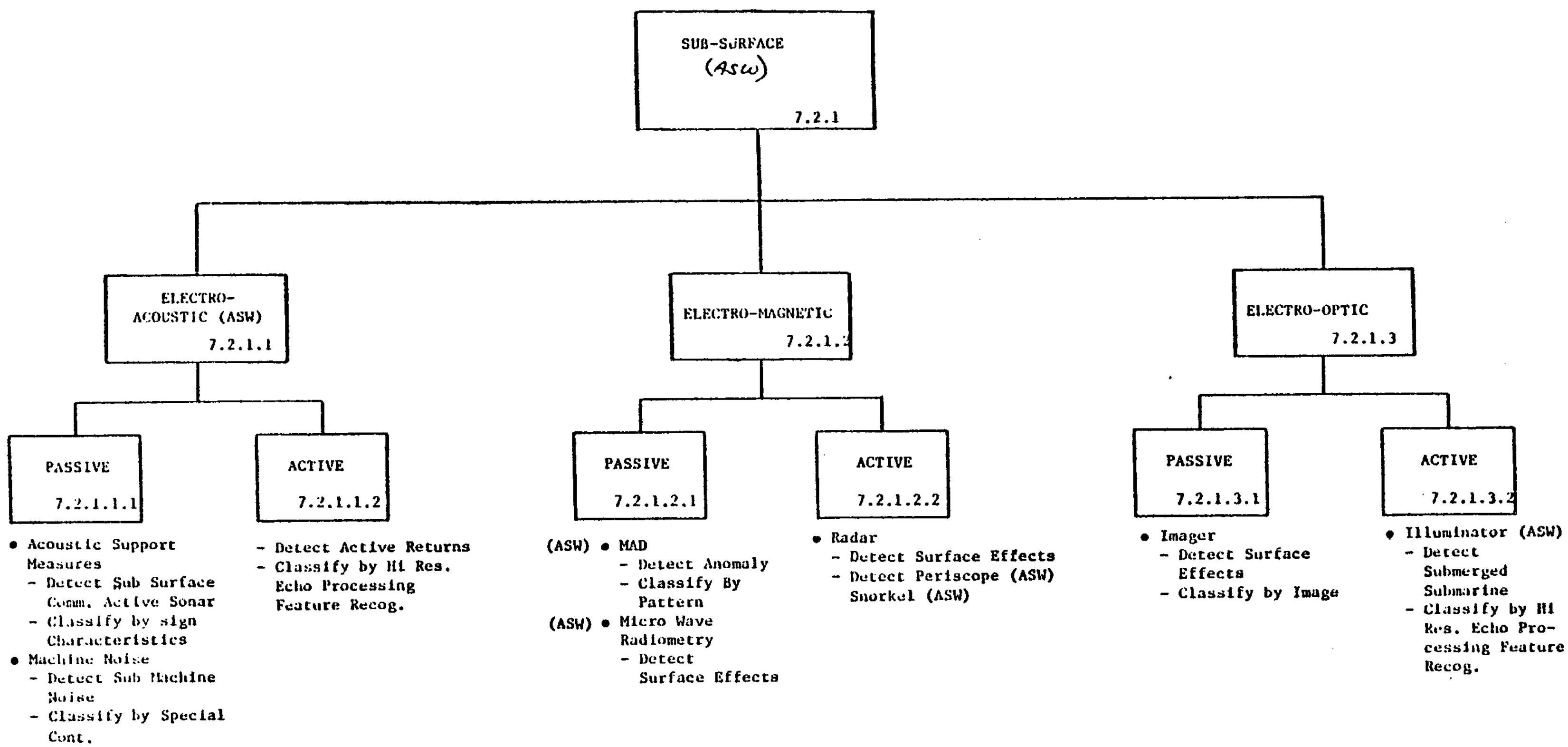
Table IV-8. Interfaces Between the Sensor Safety Function and Other Functions

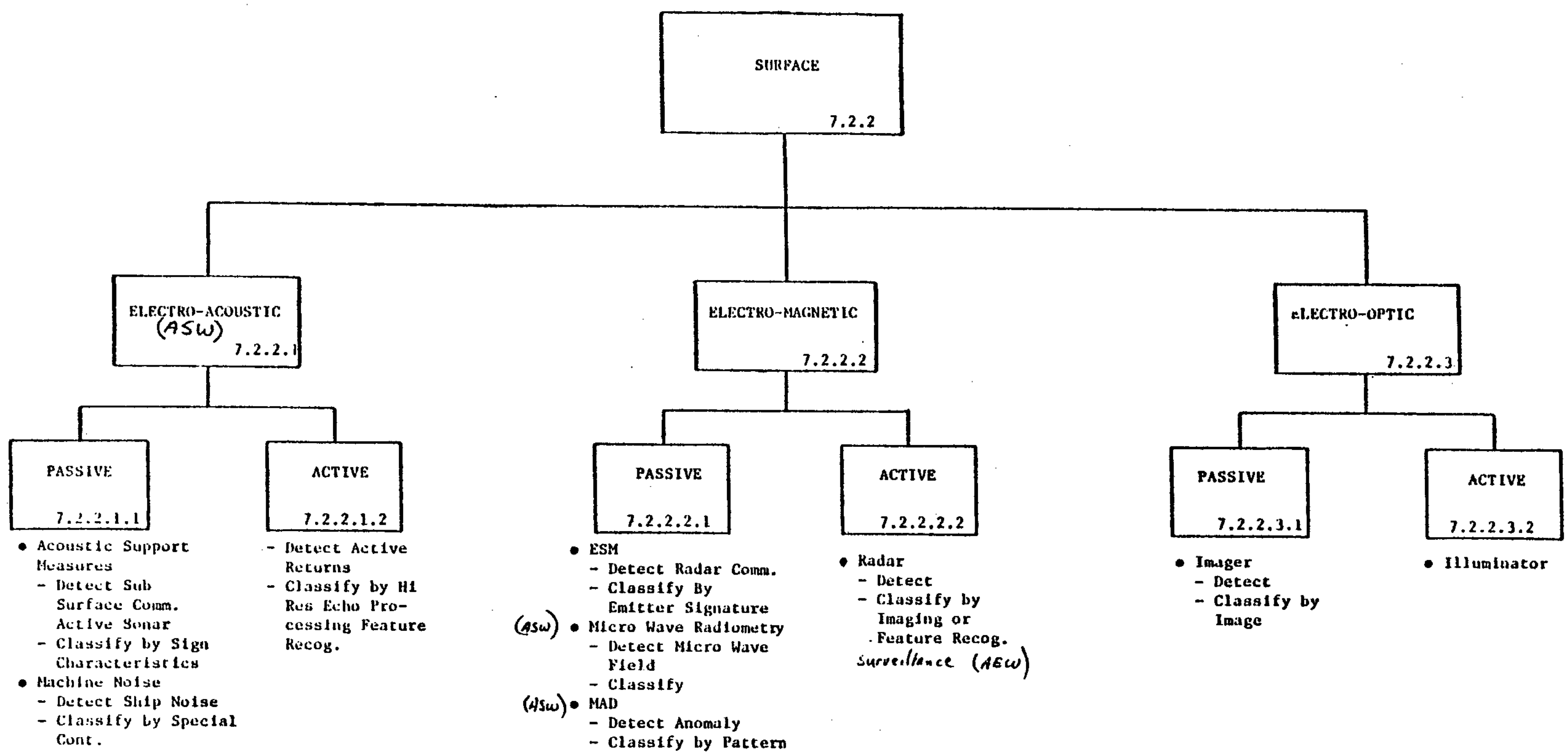
Subsystem	Function	Inputs from	Outputs to
1.0 System Processing	1.1 - Initialization	Initial control (parameters, settings).	Status of sensor system.
	1.2 - Recovery	Reset control settings which existed before failure.	Sensor system status after failure.
	1.4 - Tactical	Sensor mode and parameter changes.	Status update.
	1.7 - Information Correlation and Resolution		Sensor data.
2.0 System Display and Control	2.1 - Display of System Data		Sensor data
	2.2 - Display of Sensor Information		Sensor data.
4.0 Navigation	4.5 - Mission Sensors	Aircraft attitude and heading, aircraft ground track.	

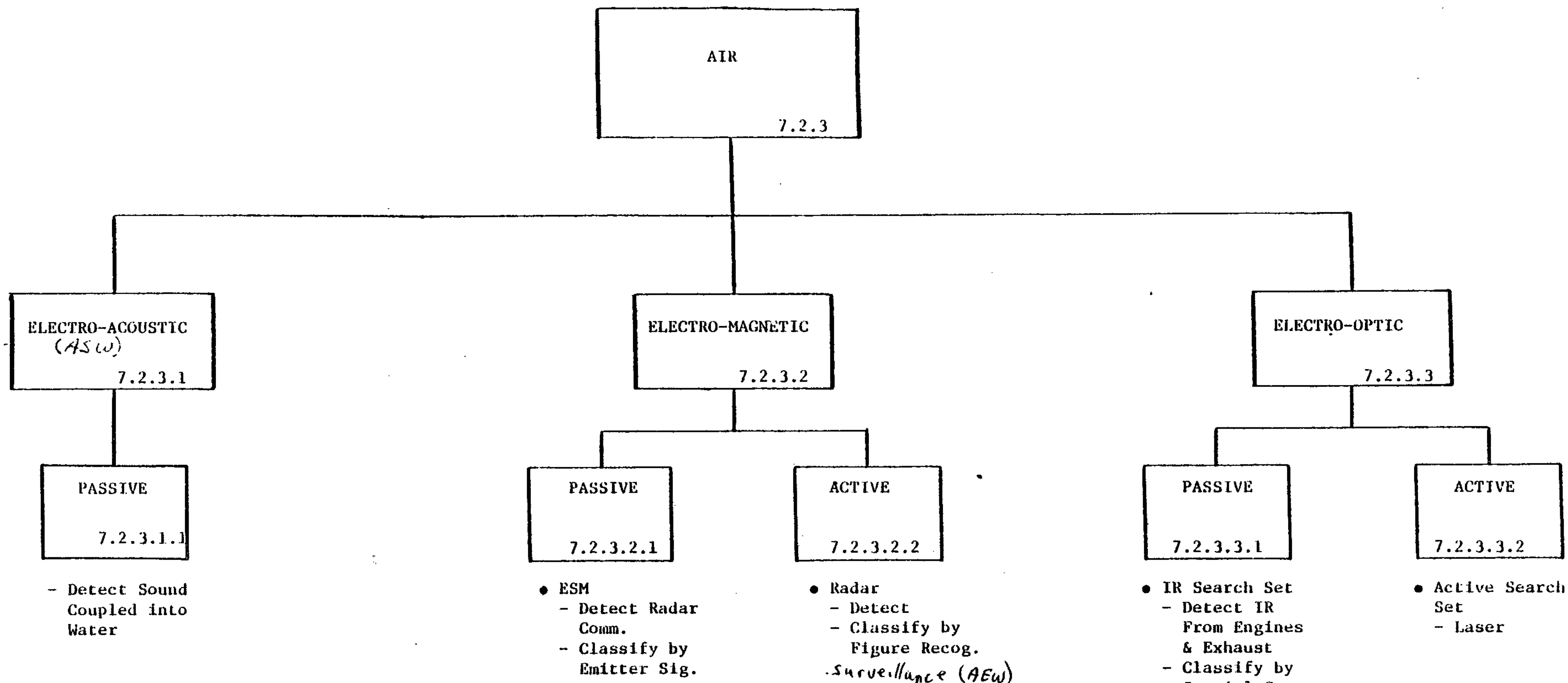

SENSORS 7.0
SENSOR SYSTEM MANAGEMENT 7.1
DETECT & CLASSIFY 7.2
LOCALIZE & TRACK 7.3
ATTACK SUPPORT 7.4
NAVIGATION SUPPORT 7.5
SAFETY 7.6

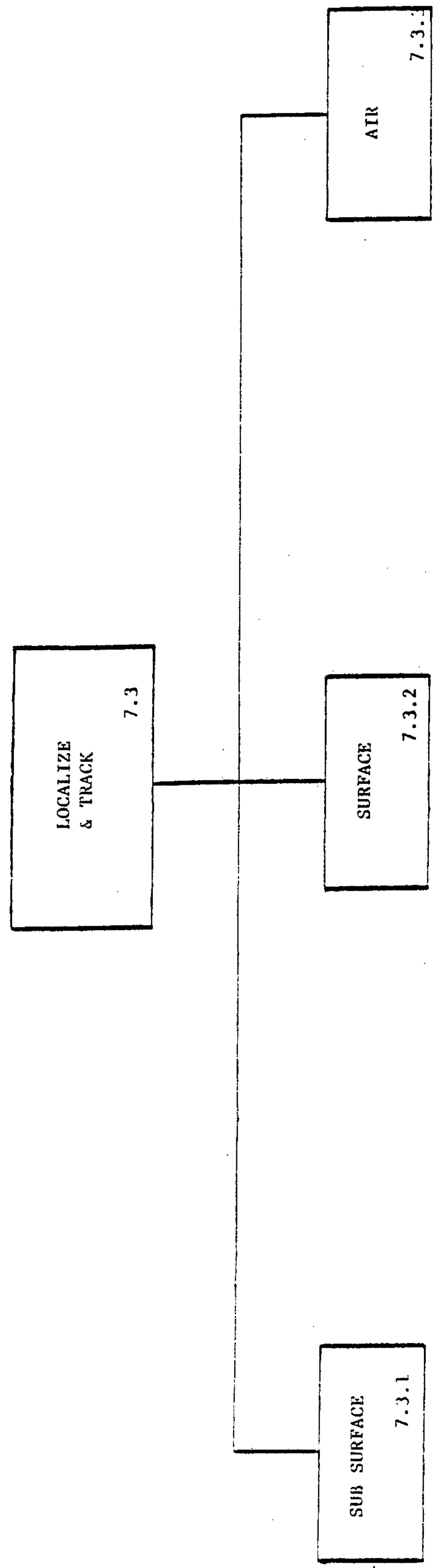

SENSOR
SYSTEM MANAGEMENT
7.1
INITIALIZATION &
RECOVERY
7.1.1
PRIORITY
MANAGEMENT
7.1.2
CONFIGURATION
CONTROL
7.1.3
SYSTEM TEST
7.1.4
IFPM
7.1.5
DATA EXTRACTION
7.1.6

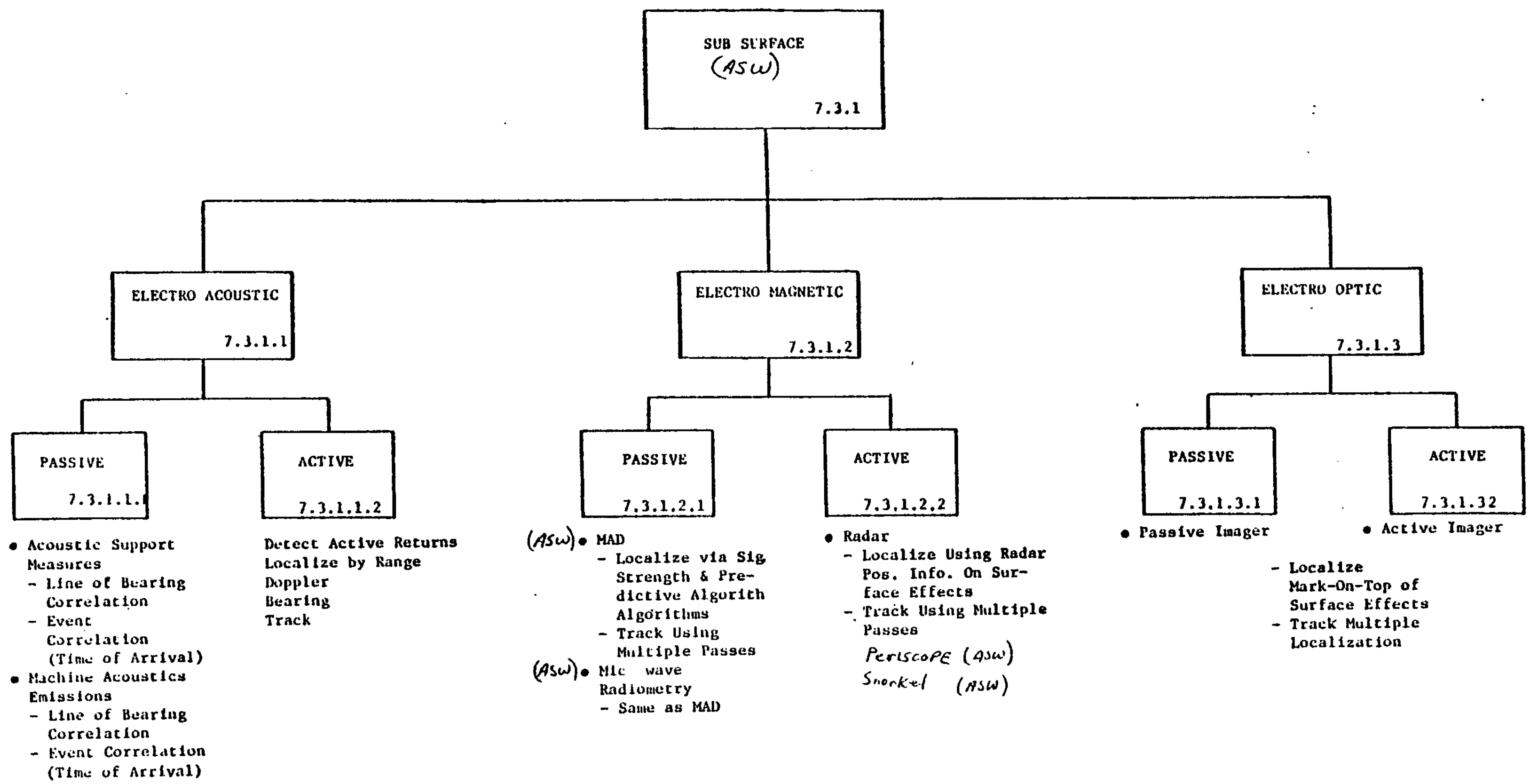

DETECT & CLASSIFY
7.2
SUB-SURFACE
7.2.1
SURFACE
7.2.2
AIR
7.2.3


SUB-SURFACE
(ASW)
7.2.1
ELECTRO-ACOUSTIC (ASW)
7.2.1.1
ELECTRO-MAGNETIC
7.2.1.2
ELECTRO-OPTIC
7.2.1.3
PASSIVE
7.2.1.1.1
ACTIVE
7.2.1.1.2
PASSIVE
7.2.1.2.1
ACTIVE
7.2.1.2.2
PASSIVE
7.2.1.3.1
ACTIVE
7.2.1.3.2
• Acoustic Support Measures
- Detect Sub Surface Comm. Active Sonar
- Classify by sign Characteristics
• Machine Noise
- Detect Sub Machine Noise
- Classify by Special Cont.
- Detect Active Returns
- Classify by Hi Res. Echo Processing Feature Recog.
(ASW) • MAD
- Detect Anomaly
- Classify By Pattern
(ASW) • Micro Wave Radiometry
- Detect Surface Effects
• Radar
- Detect Surface Effects
- Detect Periscope (ASW) Snorkel (ASW)
• Imager
- Detect Surface Effects
- Classify by Image
• Illuminator (ASW)
- Detect Submerged Submarine
- Classify by Hi Res. Echo Processing Feature Recog.


SURFACE
7.2.2
ELECTRO-ACOUSTIC
(ASW)
7.2.2.1
ELECTRO-MAGNETIC
7.2.2.2
ELECTRO-OPTIC
7.2.2.3
PASSIVE
7.2.2.1.1
ACTIVE
7.2.2.1.2
PASSIVE
7.2.2.2.1
ACTIVE
7.2.2.2.2
PASSIVE
7.2.2.3.1
ACTIVE
7.2.2.3.2
• Acoustic Support Measures
- Detect Sub Surface Comm. Active Sonar
- Classify by Sign Characteristics
• Machine Noise
- Detect Ship Noise
- Classify by Special Cont.
- Detect Active Returns
- Classify by Hi Res Echo Processing Feature Recog.
• ESM
- Detect Radar Comm.
- Classify By Emitter Signature
(ASW) • Micro Wave Radiometry
- Detect Micro Wave Field
- Classify
(ASW) • MAD
- Detect Anomaly
- Classify by Pattern
• Radar
- Detect
- Classify by Imaging or Feature Recog.
Surveillance (AEW)
• Imager
- Detect
- Classify by Image
• Illuminator


AIR
7.2.3
ELECTRO-ACOUSTIC
(ASW)
7.2.3.1
PASSIVE
7.2.3.1.1
- Detect Sound Coupled into Water
ELECTRO-MAGNETIC
7.2.3.2
PASSIVE
7.2.3.2.1
• ESM
- Detect Radar Comm.
- Classify by Emitter Sig.
ACTIVE
7.2.3.2.2
• Radar
- Detect
- Classify by Figure Recog.
. Surveillance (AEW)
ELECTRO-OPTIC
7.2.3.3
PASSIVE
7.2.3.3.1
• IR Search Set
- Detect IR From Engines & Exhaust
- Classify by Special Content
ACTIVE
7.2.3.3.2
• Active Search Set
- Laser


LOCALIZE & TRACK
7.3
SUB SURFACE
7.3.1
SURFACE
7.3.2
AIR
7.3.



SUB SURFACE
(ASW)
7.3.1
ELECTRO ACOUSTIC
7.3.1.1
ELECTRO MAGNETIC
7.3.1.2
ELECTRO OPTIC
7.3.1.3
PASSIVE
7.3.1.1.1
ACTIVE
7.3.1.1.2
PASSIVE
7.3.1.2.1
ACTIVE
7.3.1.2.2
PASSIVE
7.3.1.3.1
ACTIVE
7.3.1.32
• Acoustic Support Measures
- Line of Bearing Correlation
- Event Correlation (Time of Arrival)
• Machine Acoustics Emissions
- Line of Bearing Correlation
- Event Correlation (Time of Arrival)
Detect Active Returns
Localize by Range
Doppler
Bearing
Track
(ASW) • MAD
- Localize via Sig Strength & Predictive Algorith Algorithms
- Track Using Multiple Passes
(ASW) • Mic wave Radiometry
- Same as MAD
• Radar
- Localize Using Radar Pos. Info. On Surface Effects
- Track Using Multiple Passes
Periscope (ASW)
Snorkel (ASW)
• Passive Imager
• Active Imager
- Localize Mark-On-Top of Surface Effects
- Track Multiple Localization

- SURFACE 7.3.2
  - ELECTRO-ACOUSTIC (ASW) 7.3.2.1
    - PASSIVE 7.3.2.1.1
      - • Acoustic Support Measures
        - Line of Bearing Correlation
        - Event Correlation
      - • Machine Acoustic Emissions
        - Lob Correlation
        - Event Correlation
    - ACTIVE 7.3.2.1.2
      - • Detect
        - Active Returns
      - • Localize
        - Range
        - Line of Bearing
        - Cross Fix
        - Doppler
      - • Track
  - ELECTRO-MAGNETIC 7.3.2.2
    - PASSIVE 7.3.2.2.1
      - • MAD (ASW)
        - Localize via Sig. Strengths & Predictive Algorithms
        - Track Using Multiple Passes
      - • Microwave Radiometry
        - Same as MAD
      - • ESM
        - Localize Line of Bearing of Event Correlation
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      - • Radar
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    - PASSIVE 7.3.2.3.1
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        - Track Multiple Loc.
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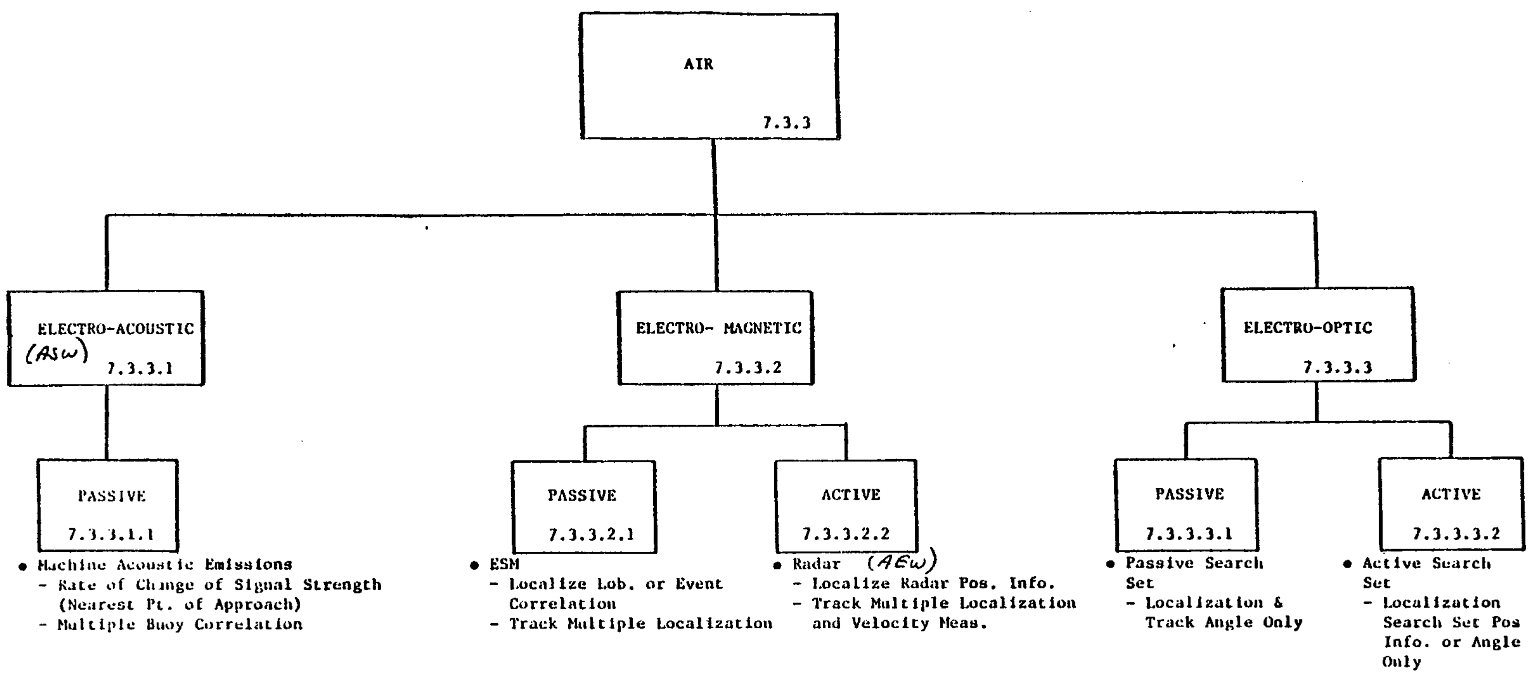
    - ACTIVE 7.3.2.3.2
      - • Active Imager
        - Localize Lob Corr.
        - Track Multi. Loc.
      - • Active Search Set
        - Localize Search Set Pos. or Lob Corr.
        - Track Multi. Loc.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(ASW)
7.3.3.1
ELECTRO- MAGNETIC
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7.3.3.3
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7.3.3.2.1
• ESM
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- Track Multiple Localization
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7.3.3.2.2
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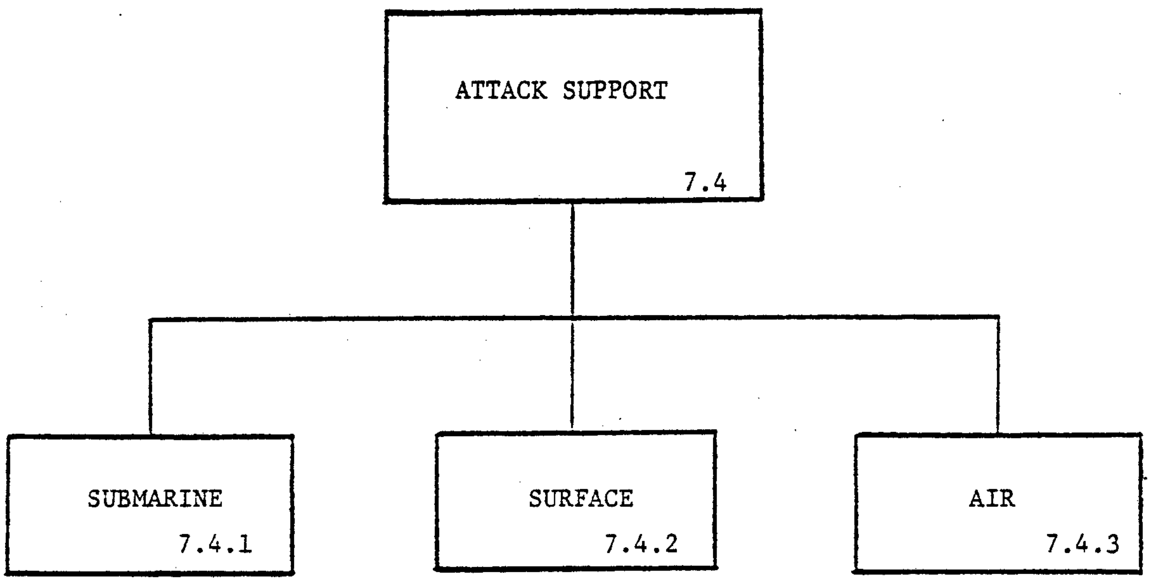
- Track Multiple Localization and Velocity Meas.
PASSIVE
7.3.3.3.1
• Passive Search Set
- Localization & Track Angle Only
ACTIVE
7.3.3.3.2
• Active Search Set
- Localization Search Set Pos Info. or Angle Only


ATTACK SUPPORT
7.4
SUBMARINE
7.4.1
SURFACE
7.4.2
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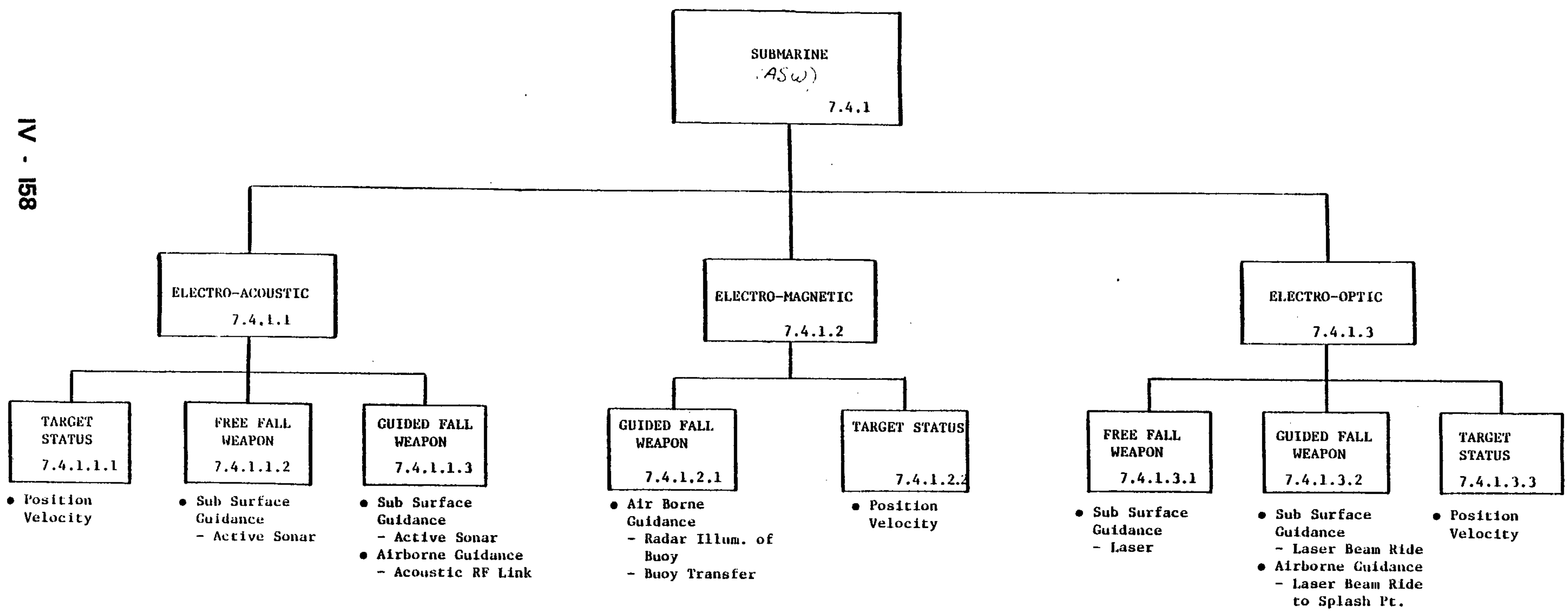

SUBMARINE
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7.4.1
ELECTRO-ACOUSTIC
7.4.1.1
ELECTRO-MAGNETIC
7.4.1.2
ELECTRO-OPTIC
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7.4.1.1.2
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7.4.1.3.2
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- Laser Beam Ride
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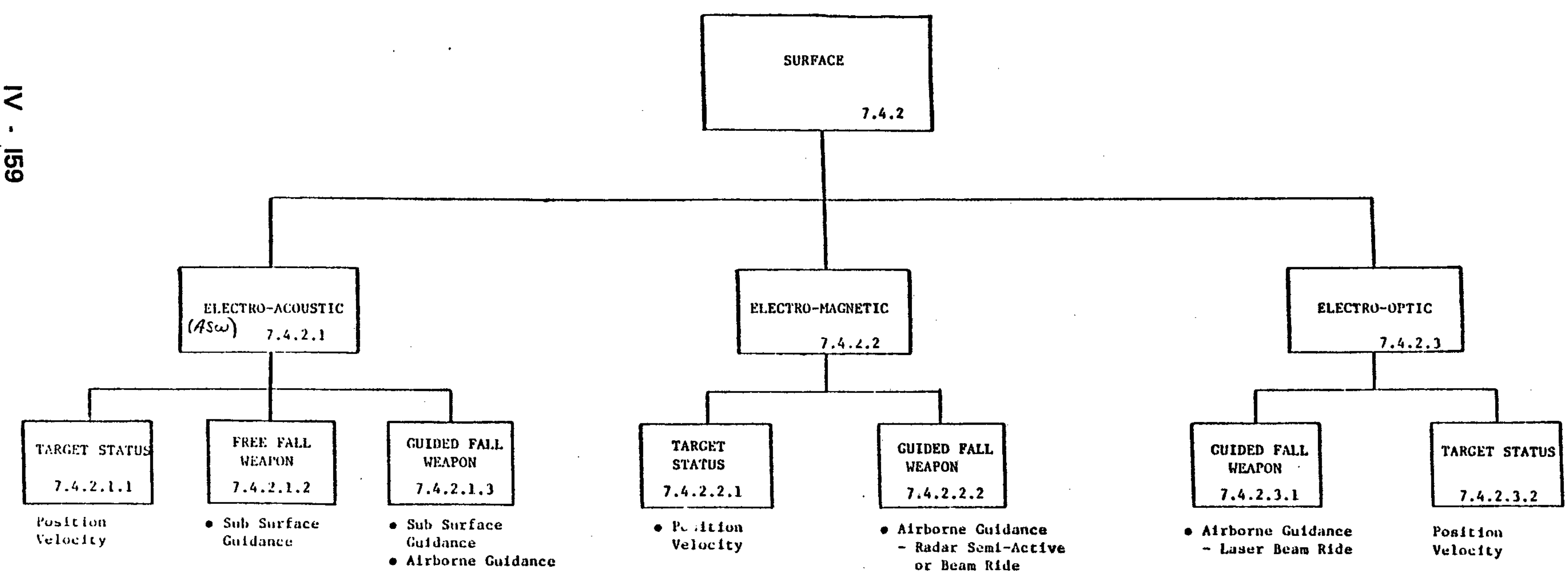
TARGET STATUS
7.4.1.3.3
• Position
Velocity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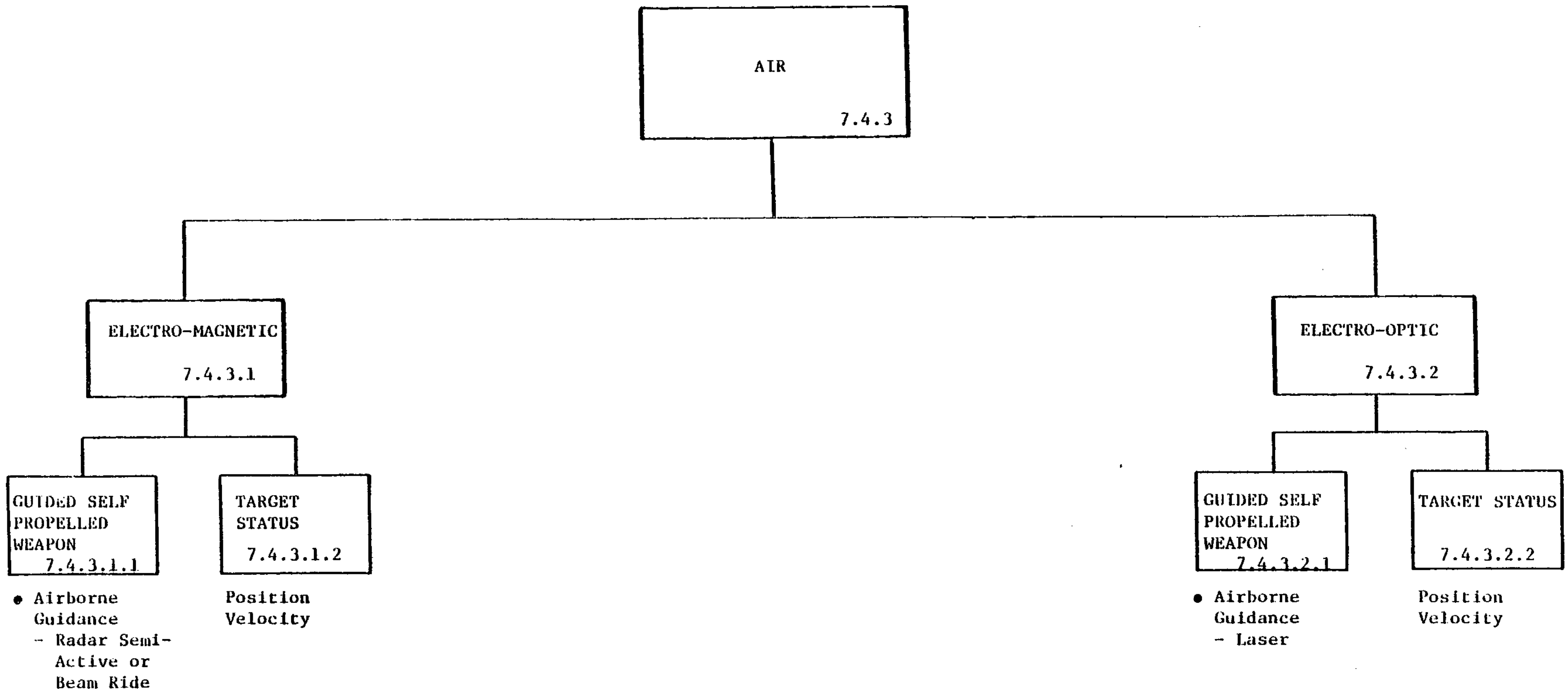
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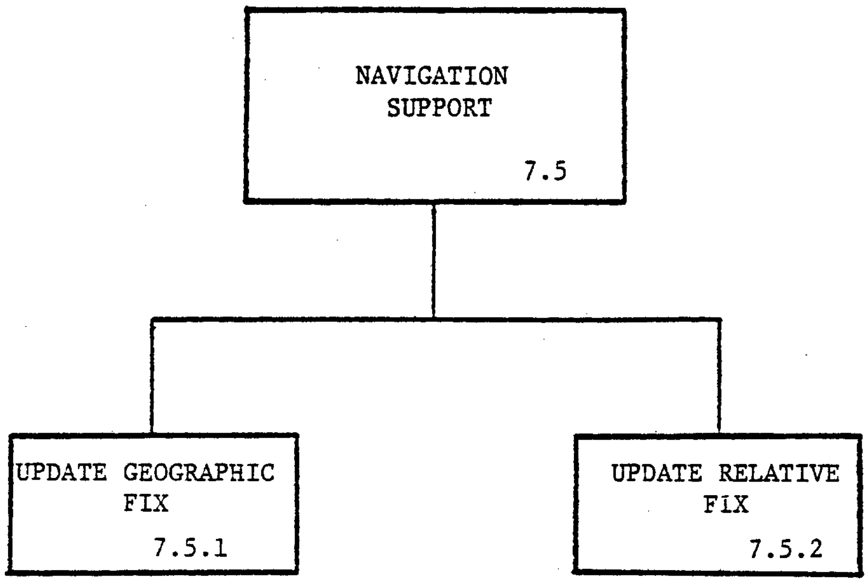
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7.5
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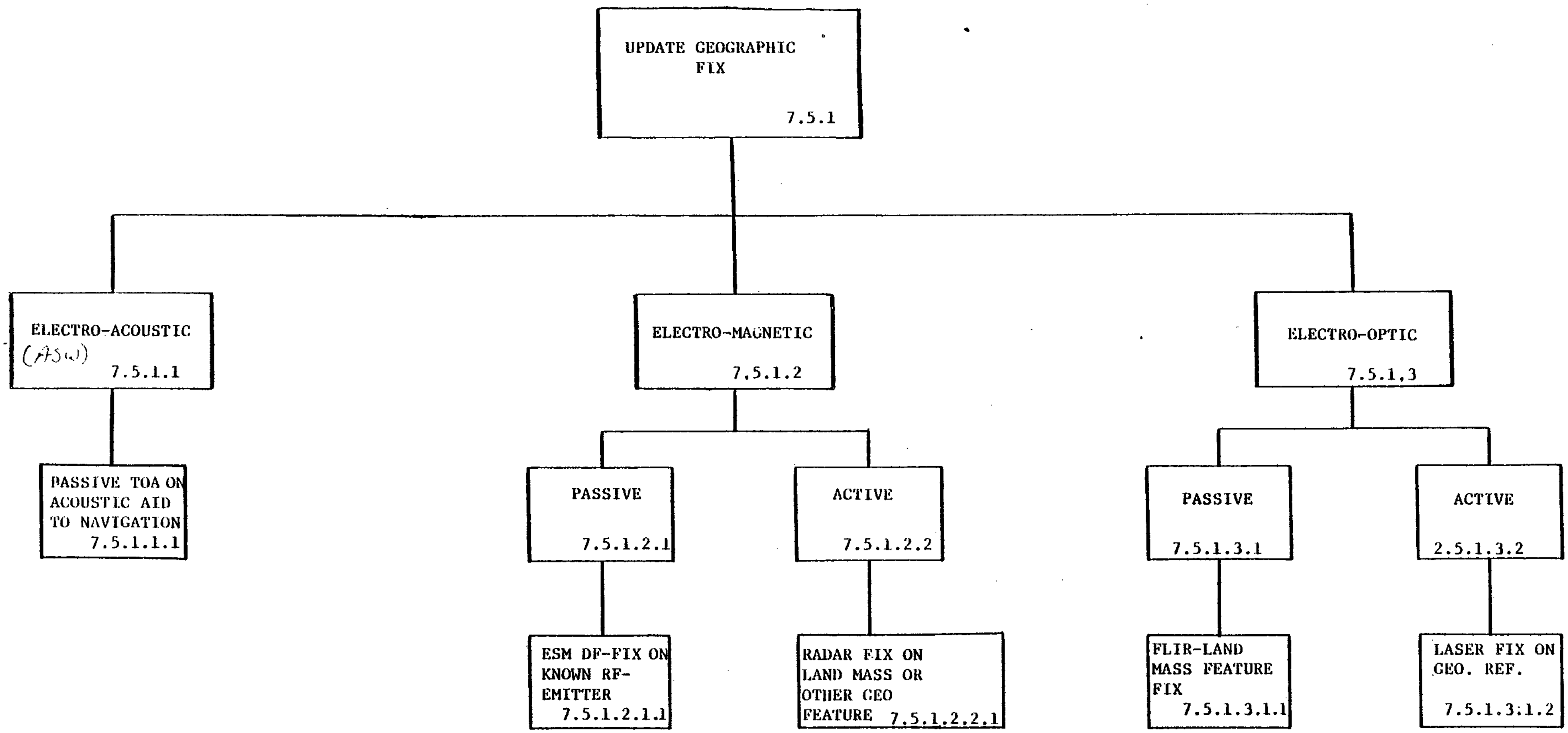
UPDATE GEOGRAPHIC FIX
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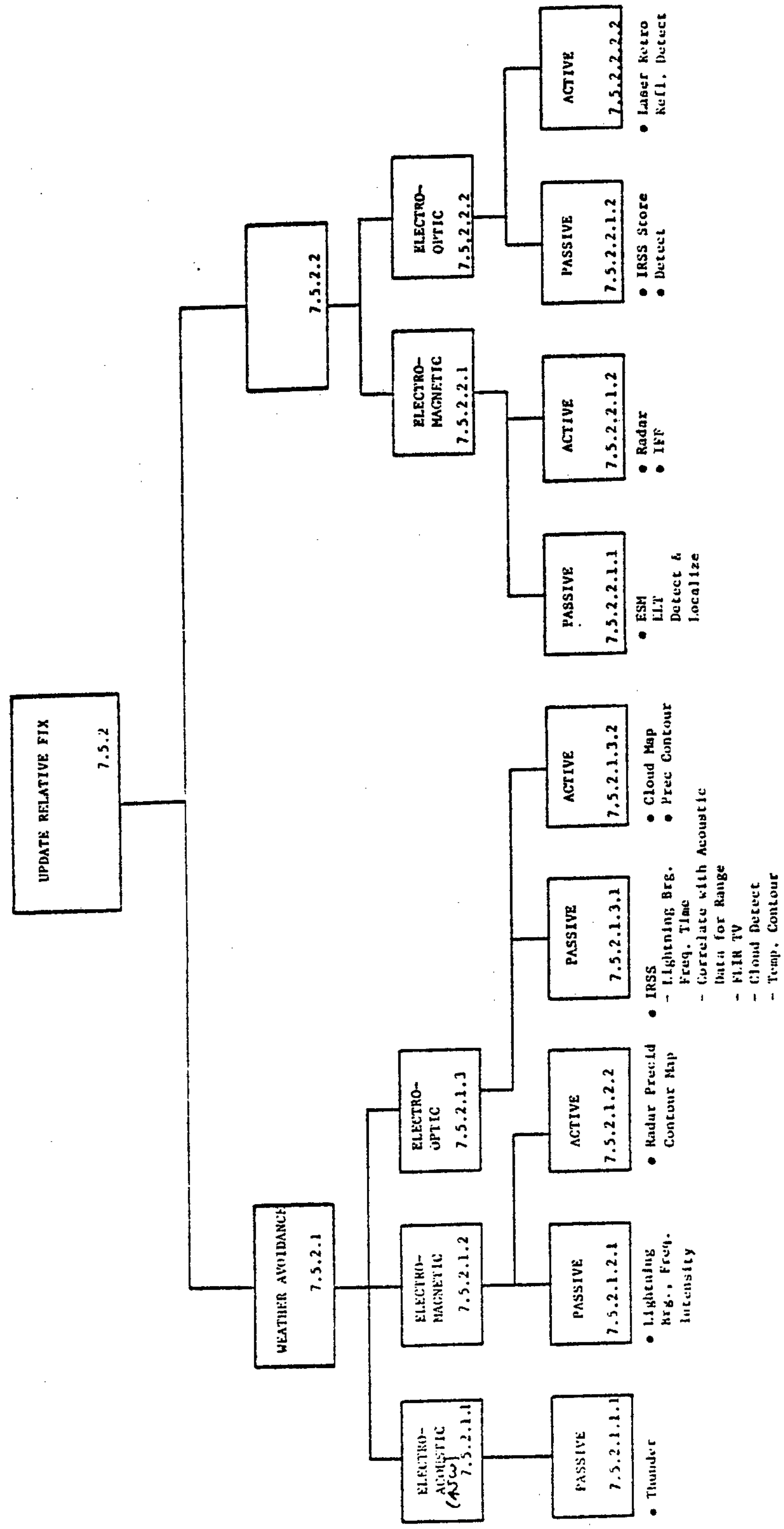
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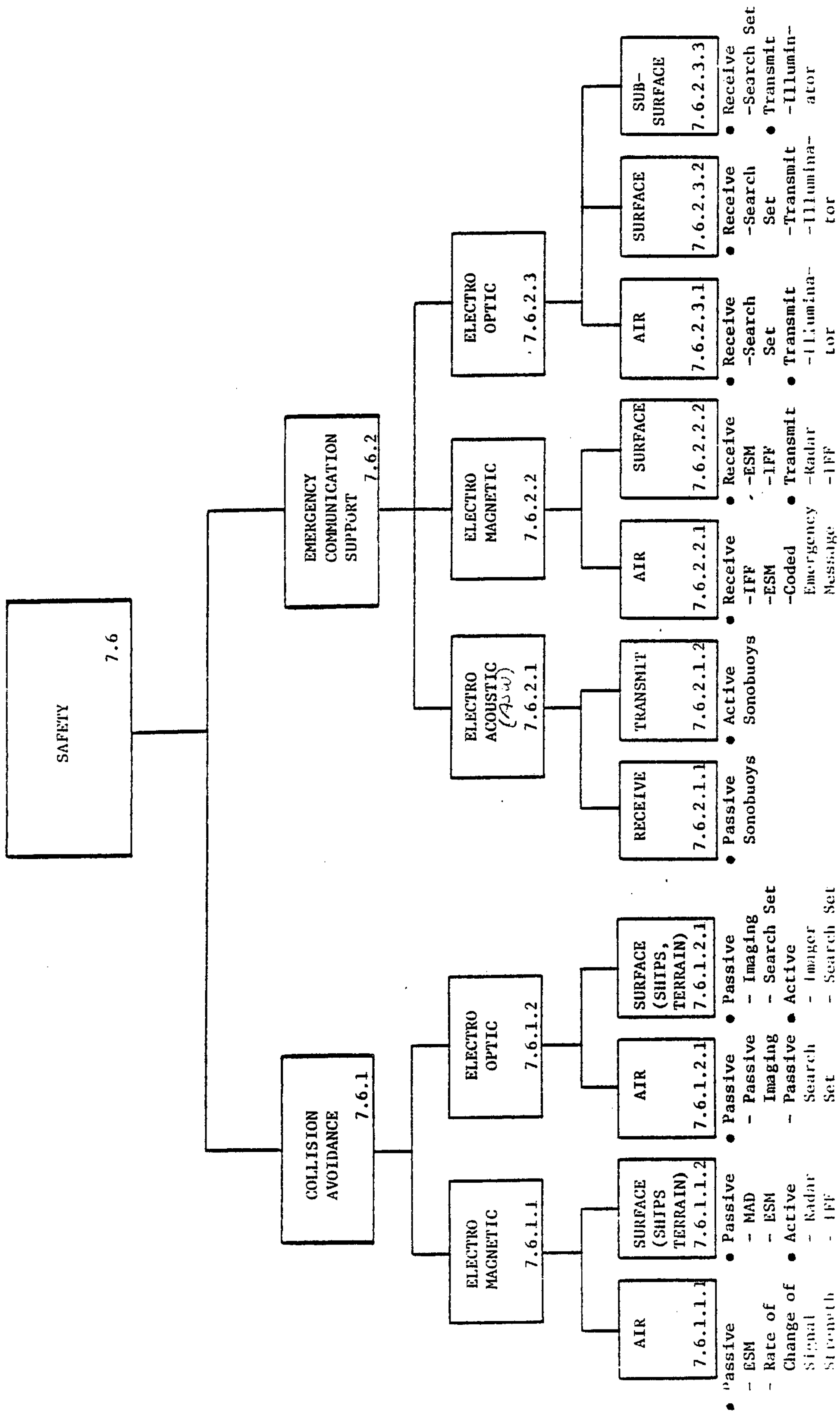
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-IFF
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-Radar
-IFF
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SUB-SURFACE 7.6.2.3.3
• Receive
-Search Set
• Transmit
-Illuminator

8.0 COUNTERMEASURES

Introduction: Countermeasures are concerned with preventing hostile forces from gaining knowledge about the disposition of a force. It also provides for impeding targeting by the hostile force, neutralizing launched weapons and self defense of the V/STOL aircraft.

8.1 PREVENT DETECTION

Inputs: Classification, location, and track (if available) of hostile aircraft.

Outputs: Either maintain EMCON of fleet ships and V/STOL 'A' aircraft or activate broadband and deceptive jamming techniques.

Functional Description: The V/STOL 'A' can help prevent both its' own and the fleet's detection by hostile forces by using one of the following means:

a. Insure EMCON-The V/STOL aircraft does not radiate any electromagnetic energy during EMCON, while monitoring any fleet emissions. The aircraft will report if it detects any spurious radiation eminating from the fleet.

b. Minimize Infrared Emissions.

c. Mask airframe through the use of flares and chaff. This measure will be performed during the mission.

8.2 IMPEDE TARGETING

Inputs: Classification, location, track, and weapons launch capability (if available) of hostile aircraft.

Outputs: Either maintain EMCON aboard the fleet ships and V/STOL 'A' aircraft or activate broadband and deceptive jamming techniques.

Functional Description: The V/STOL 'A' will attempt to prevent a hostile aircraft from gaining "target acquisition" on any of the fleet ships or aircraft. It will impede this targeting by using one of the following methods:

a. Insure EMCON-This will preclude the hostile aircraft from locking onto any radiation eminating from the fleet.

b. Disrupt Communications-The V/STOL 'A' will activate a broadband jammer.

c. Deceive Communications-The V/STOL 'A' will activate a deception jammer which will present false targets to the hostile aircraft.

8.3 NEUTRALIZE WEAPON

Inputs: Tracking and classification information on incoming weapon.

Outputs: Activation of broadband and deception jammers, and release of chaff and flares.

Functional Description: The V/STOL 'A' has the requirement to neutralize a weapon, after it is launched by a hostile platform. There are two methods of neutralization available:

a. Disrupt sensor and command and control transmissions of the hostile platform by activating a broadband jammer and/or releasing chaff.

b. Deceive sensor and command and control transmissions by activating a deception jammer and/or flare.

8.4 SELF DEFENSE

Inputs: Not applicable

Outputs: Measures to reduce electronic detectability.

Functional Description: Measures will be incorporated into the V/STOL 'A' to provide for self defense by reducing electronic detectability. These measures include:

a. Minimize radar cross section.

b. Disrupt sensors aboard hostile aircraft. The V/STOL 'A' will activate broadband jammer and dispense chaff to disrupt sensors aboard the hostile aircraft.

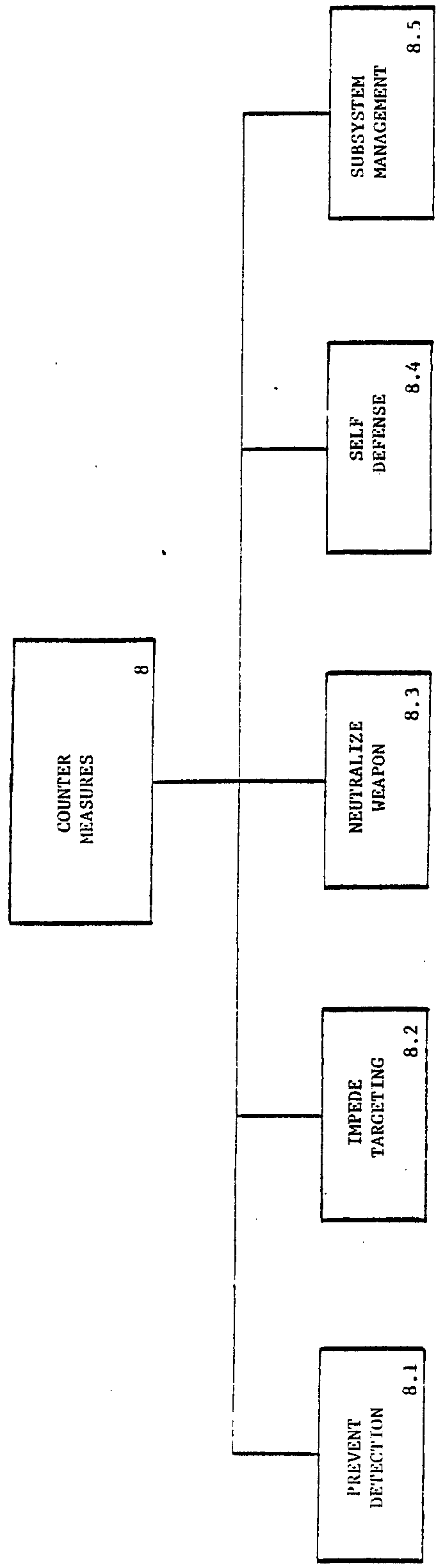
c. Deceive sensors aboard hostile aircraft. The V/STOL 'A' will activate a deception jammer and release flares to deceive sensors aboard the hostile aircraft.

8.5 COUNTERMEASURES SUBSYSTEM MANAGEMENT

Inputs: Mission configuration control data, manual control entries received via the display and control subsystem (i.e., turn-on of a jammer), and commands generated by the system controller.

Outputs: Control of the V/STOL countermeasures subsystem including: release of flares and chaff, and initiation of active jamming measures.

Functional Description: The countermeasures subsystem will be functionally initialized in a manner consistent with the system controller initialization (see Section 1.1). This includes the execution of built-in-test, system test, and the loading of operational software and apriori data. The mission data extraction, recovery, and configuration functions will be as described in Sections 1.2, 1.3, 1.5.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PREVENT DETECTION 8.1
IMPEDE TARGETING 8.2
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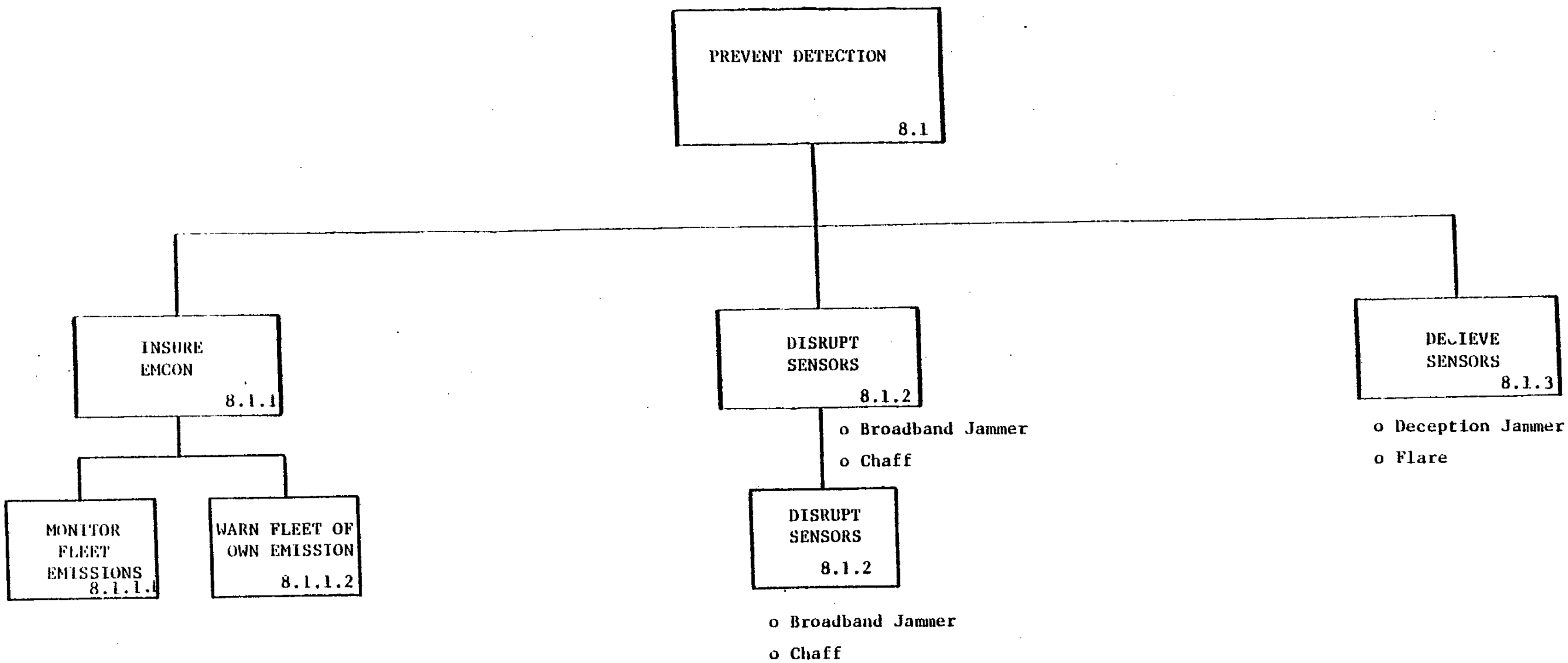
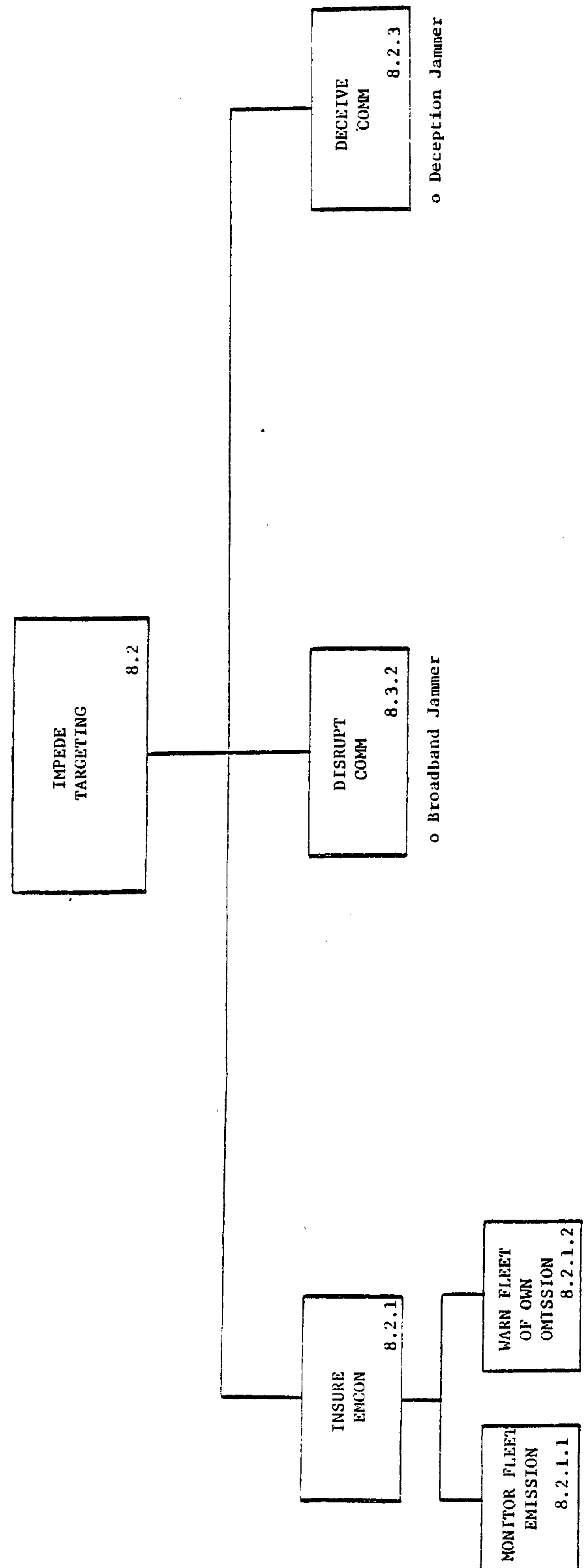

PREVENT DETECTION
8.1
INSURE
EMCON
8.1.1
MONITOR
FLEET
EMISSIONS
8.1.1.1
WARN FLEET OF
OWN EMISSION
8.1.1.2
DISRUPT
SENSORS
8.1.2
o Broadband Jammer
o Chaff
DISRUPT
SENSORS
8.1.2
o Broadband Jammer
o Chaff
DECIEVE
SENSORS
8.1.3
o Deception Jammer
o Flare


IMPEDE TARGETING
8.2
INSURE EMCON
8.2.1
MONITOR FLEET EMISSION
8.2.1.1
WARN FLEET OF OWN OMISSION
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DISRUPT COMM
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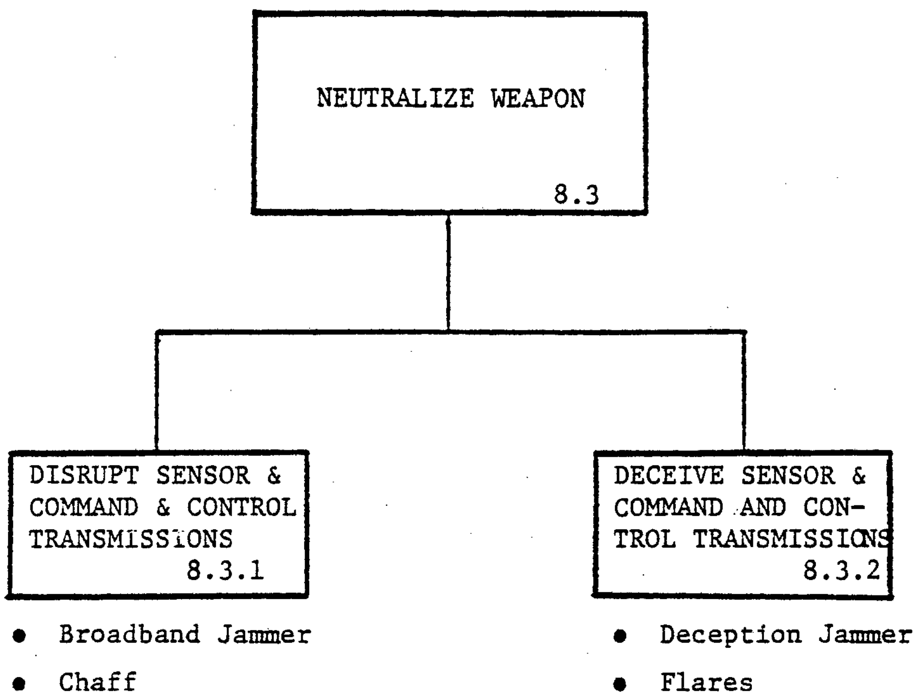
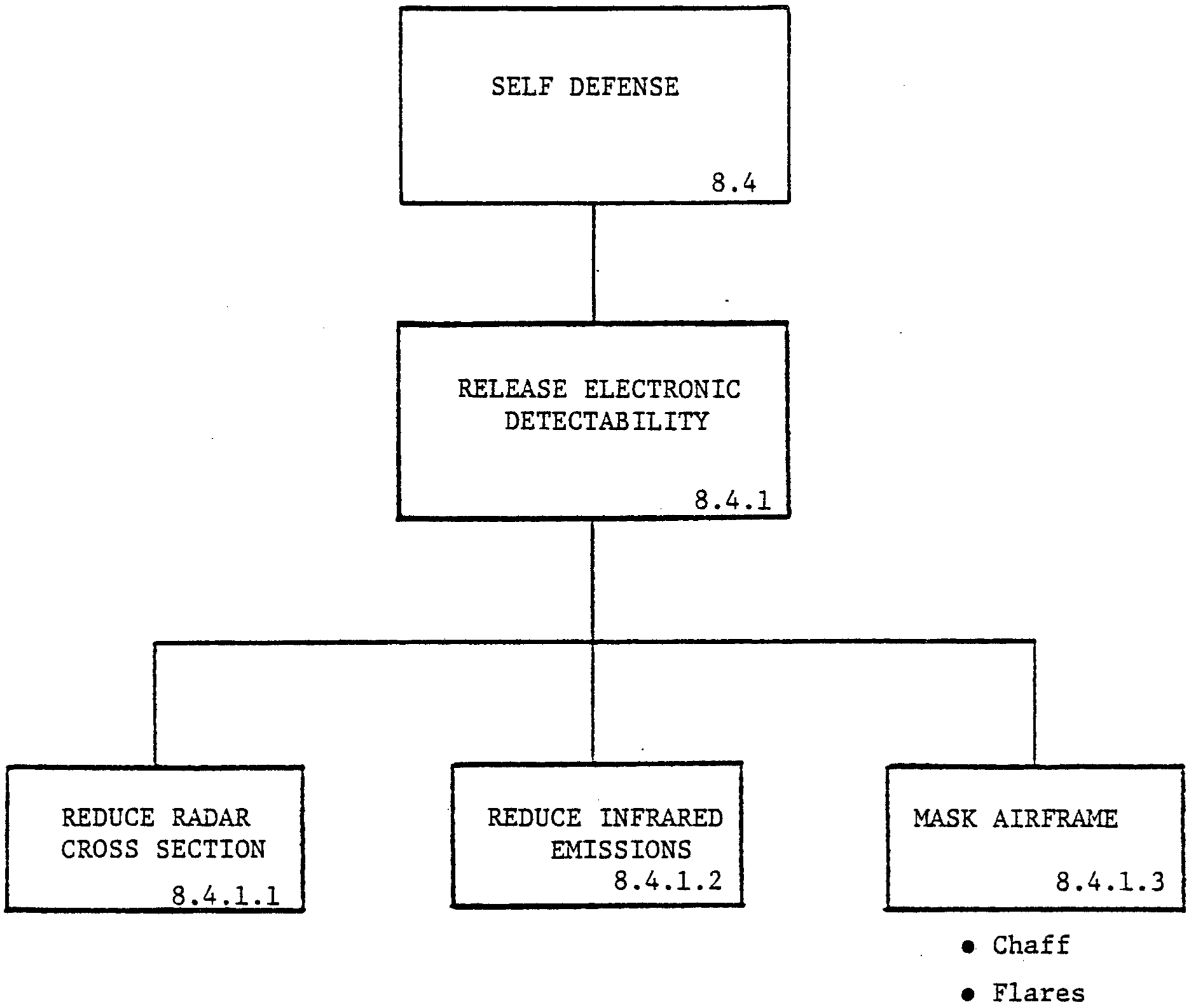
o Broadband Jammer
DECEIVE COMM
8.2.3
o Deception Jammer


NEUTRALIZE WEAPON
8.3
DISRUPT SENSOR & COMMAND & CONTROL TRANSMISSIONS
8.3.1
• Broadband Jammer
• Chaff
DECEIVE SENSOR & COMMAND AND CONTROL TRANSMISSIONS
8.3.2
• Deception Jammer
• Flares


SELF DEFENSE
8.4
RELEASE ELECTRONIC DETECTABILITY
8.4.1
REDUCE RADAR CROSS SECTION
8.4.1.1
REDUCE INFRARED EMISSIONS
8.4.1.2
MASK AIRFRAME
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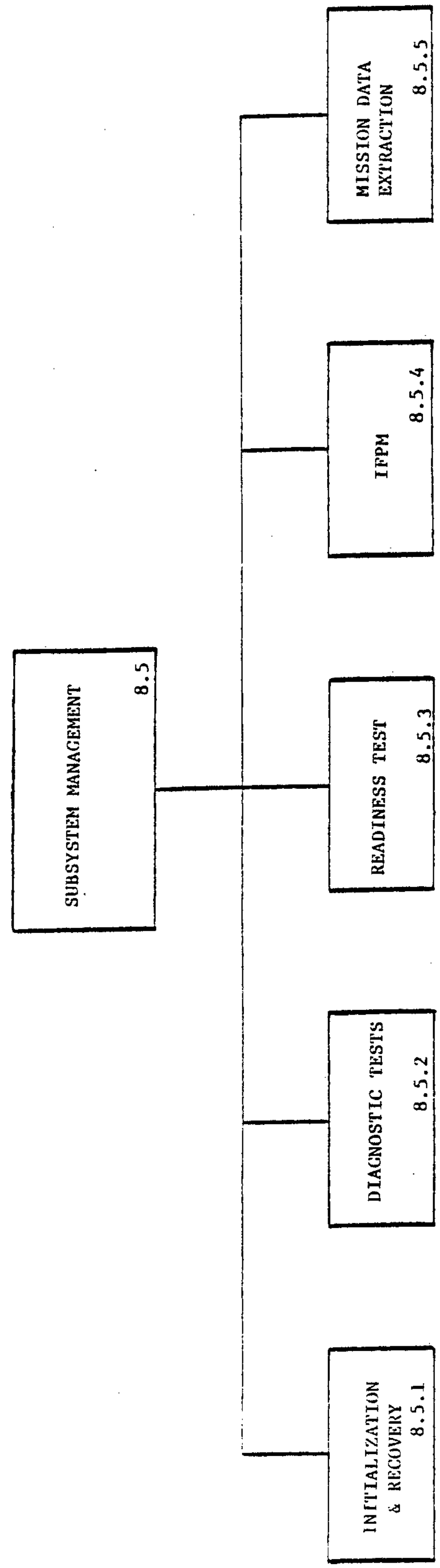
• Chaff
• Flares


SUBSYSTEM MANAGEMENT
8.5
INITIALIZATION & RECOVERY
8.5.1
DIAGNOSTIC TESTS
8.5.2
READINESS TEST
8.5.3
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8.5.5

9.0 STORES MANAGEMENT (SMS)

Functional Description: The SMS performs initialization, test, control (including normal store separation) and jettison of stores. It performs these functions by interfacing and exchanging data with numerous other aircraft subsystems, and by controlling the Suspension and Release Equipment (S&RE) and stores. The subsystem formed by the SMS, S&RE and stores is referred to as the Aircraft Armament System (AAS).

The SMS operates under exceutive control of the aircraft avionics system. The avionics data processor(s) initiates and terminates the SMS operation; stages the powering up and down of aircraft subsystems; queries and assesses AAS health; provides master mode control inputs and overall aircraft regression mode control; and performs the control and processing for accessing multifunction displays, controls and signal processors.

The SMS obtains data support from the other aircraft systems for processing tasks done within the SMS and for transfer to the S&RE and stores. It provides data support to the other aircraft systems by reporting status, health and configuration of the AAS and by transferring data generated within the stores to various points within the aircraft.

The SMS employs a minimum of dedicated equipment, relying heavily on multifunctional devices. In this way, weight, space, power and environmental control economies are realized; and flexibility is enhanced for adapting new stores and for effecting procedural changes.

The SMS relies on the avionics for target acquisition and designation and for fire control solutions. It relies on the navigation and flight control subsystems for information regarding platform dynamics and navigational parameters needed for control of S&RE and initialization of stores. The SMS relies on the countermeasures subsystem for initialization and control of countermeasure and threat-sensing stores. The communications subsystem is relied upon for external data input and for transfer of AAS data and commands to stores (post-separation) and to maintenance support activities (preparation for maintenance).

Inputs: Aircraft state data; operator commands and queries; data, commands and queries from the aircraft systems; electrical power; Suspension and Release (S&RE) and store status data; store sensor and processor outputs; S&RE and store data queries; command-control responses.

Outputs: Cues, queries and data to the operator(s); SMS, S&RE and stores health/status data; SMS, S&RE and store data; electrical power to the S&RE and stores; commands and data to the S&RE and stores; command-control reponses.

9.1 INITIALIZE AAS/STORES

Functional Description: The AAS is brought into a ready state, involving powering up the SMS, S&RE and stores; setting up or changing store release parameters and targeting information; and setting conditions, transferring data and enabling cooling, tuning, etc. as required to prepare the S&RE and stores for use.

Standby power is provided to the AAS so that store parameters can be read by the SMS in preparation for full power-up. Store parameters include location, type, quantity, configuration and status. These parameters may be manually entered into the system by the ordnance crew and/or obtained via an automatic readout technique. Once the store parameters have been determined, the SMS is programmed for the store loadout. This may be done automatically by retrieving the proper computer programs from aircraft bulk storage, or by loading the programs into the aircraft from an exterior source. Safety conditions (rack interlocks, etc.) are tested and set, and operating power is supplied to the AAS.

Inventory data on the store loadout is transferred to the avionics (e.g., for selecting ballistic coefficients) and to the displays (inventory/initialization status display). The aircrew selects weapon release conditions (e.g., for each store type, the quantity, fusing, release mode, interval, etc. are chosen). The aircrew also inserts targeting data as may be required for mid-course guided weapons. Weapon release condition selections are stored in the SMS for later use. Targeting data are transferred to appropriate stores. Initialization power having been applied to the stores, reference data from the avionics subsystems are transferred to the stores as required (e.g., for alignment of inertial reference units). The complete initialization process is performed for each store type (each generally being different depending on store peculiarities), following which "initialization complete" is indicated to the aircrew on the inventory/initialization status display.

Weapon release selections may be modified by the aircrew at any time prior to release.

Inputs: Master electrical power; initialize mode command; aircraft states; bulk-stored SMS programs and data; avionics reference data; operator inputs of targeting and store separation data and options.

Outputs: Cues and queries to operator on initialization tasks and options; data to operator on store inventory, configuration and initialization status; electrical power to S&RE and stores; commands to S&RE and stores for initialization processes; data to S&RE and stores for initialization purposes.

9.2 TEST AAS/STORES

Functional Description: The SMS performs a continuing foreground assessment of AAS BIT indicators. Upon recognizing a BIT failure indication, background routines are engaged as required to isolate the fault. Different background routines may be used depending on the situation. If the objective is simply to invoke degraded mode operation (i.e., to operationally counter the fault), a limited amount of fault isolation testing may be sufficient to recognize the source and enable graceful degradation. If the objective is to specifically isolate the fault for maintenance purposes, more extensive testing may be required.

In addition to the customary BIT type provisions for determining system health, there may be specific routines which are used to assess safety conditions and readiness for stores loading, and to perform post-loading verification checks.

It is desirable that the AAS be highly if not totally, self-sufficient in the testing areas, thereby reducing or eliminating the need for GSE. This is particularly important for austere base operations, but would provide benefits for all basing situations if achieved.

To facilitate quick turnaround maintenance, it is suggested that consideration be given to providing the capability for down-linking to the base, prior to recovery, data generated by the on-board testing provisions.

Inputs: Master electrical power; test mode commands and conditions; aircraft states; bulk-stored SMS programs and data; avionics data; S&RE and store data and status readouts; stimulation as required from GSE.

Outputs: Cues and advisories to operator; queries to operator, S&RE and stores; electrical power to S&RE and stores; AAS status indication to avionics; data on fault presence and location to operator and avionics; commands and data to S&RE and stores for test purposes.

9.3 CONTROL AAS/STORES

Functional Description: The SMS controls safety interlocks within the AAS, both automatically and in response to operator commands. Once airborne, S&RE interlocks are released, store sensors which were caged prior to takeoff are uncaged when appropriate, and other such housekeeping-type functions are performed depending on the store loadout.

Two types of stores are controlled: those to be carried captively throughout the flight and those to be separated from the aircraft during the flight. The operator selects the store type(s) which are to be employed at any time during the flight. More than one type may be selected simultaneously, subject to safety constraints. The act of selecting a store type indicates to the system that the operator intends to operate that store.

If the store selected is of the captive type, its operation will generally involve transferring data generated within the store to the avionics (e.g., target acquisition/designation pod) and possibly transferring avionics data to the store for slaving of its sensors, tuning of receivers, etc.

If the store type selected is of the separated variety, the store release conditions which were established during initialization are recalled and invoked. If desired, the operator may modify these conditions up to the point of release enablement. Invoking the release conditions simply programs the AAS for conducting the release. The actual release is not carried out until a number of other procedures (manual and automatic) have been carried out.

The SMS reads the condition of master safety controls (e.g., master arm), checks to see that all necessary release conditions have been established by the operator, monitors the avionics system to determine whether a computed or manual release is to be performed, selects store stations in accordance with aircraft weight and balance requirement, determines whether the S&RE and stores have been fully initialized, cues the operator on critical actions and status, monitors aircraft state and flight parameters, sets S&RE control parameters where adjustable, monitors for the engagement of target designation and release enable conditions, receives the computed release solution from the avionics system and transfers the release command to the stations in the appropriate sequence to maintain weight and balance. As the release command is issued to each station, fusing and arming initiation commands are issued for the store as it is being separated.

The SMS detects store separation, updates the on-board inventory record, stands down the stations from which stores have been separated and enables post-separation store control (where appropriate).

Inputs: Master electrical power; aircraft states; operator commands and queries; avionics reference data, commands and queries; avionics, S&RE and store status; store sensor and processor outputs; S&RE and store queries.

Outputs: Cues, queries and data to operator; AAS status data to avionics; AAS sensor and processor data to avionics; operating, firing and fusing power to S&RE and stores; commands and data to S&RE and stores.

9.4 JETTISON STORES

Functional Description: There are numerous possible jettison modes. They are unique with respect to normal store separation in that stores are jettisoned in the unarmed state.

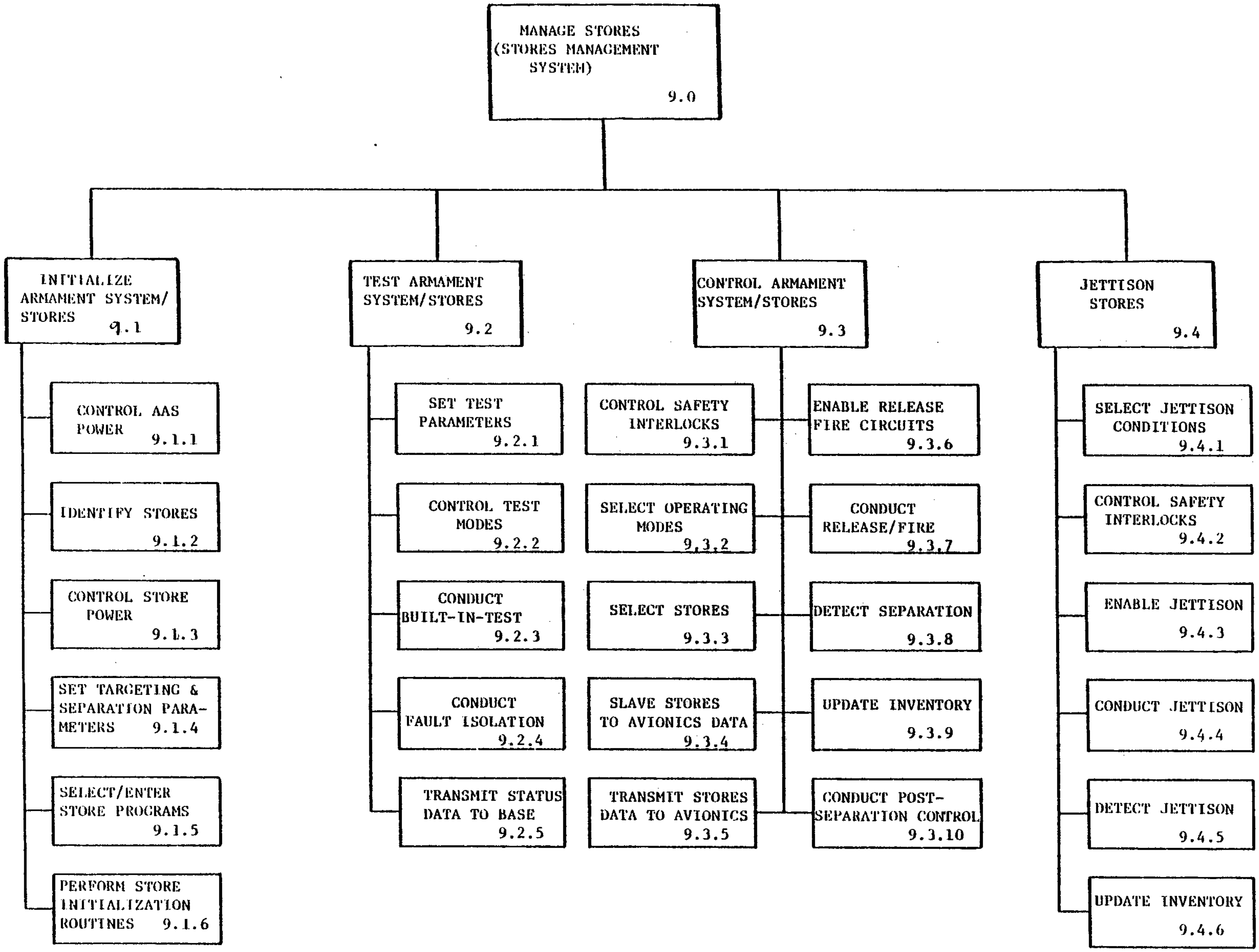
Emergency jettison involves clearing all jettisonable stores from the aircraft in a predetermined sequence and over a time interval which is dictated by aircraft structural considerations. Emergency jettison is typically commanded by a single action (dedicated control) which transfers emergency power bus stimulation direct to a special emergency jettison sequencer. Aircraft state inputs (e.g., position of landing gear and doors, flaps, and other surfaces which may interfere with store separation) may be input to the sequencer to ensure safety of jettison.

All other jettison modes would conceivably be selected, programmed and controlled by the SMS. These include Combat, Auxiliary and Selective. Combat jettison automatically clears the aircraft of stores which are nonessential to or may impede the task of air combat and/or surface threat countering. Auxiliary and Selective are fully controlled by the operator, enabling the jettison of any specific stores (auxiliary) or specific stores and the associated intermediate S&RE (selective).

For the SMS-controlled jettison modes, the operator calls for the desired mode, the SMS displays any options available, the operator picks conditions and enables the function. The SMS detects the selections engages the proper stations/stores, inhibits weapon fusing/arming initiation and activates the jettison. The SMS detects separation of stores and intermediate racks and updates the on-board inventory record.

Inputs: Master electrical power; aircraft states; jettison mode selection; jettison conditions and selections; avionics reference data; avionics, S&RE and store status.

Outputs: Cues, queries and data to operator; AAS status data to avionics; operating power to S&RE; commands to S&RE and stores.


MANAGE STORES (STORES MANAGEMENT SYSTEM) 9.0
INITIALIZE ARMAMENT SYSTEM/STORES 9.1
CONTROL AAS POWER 9.1.1
IDENTIFY STORES 9.1.2
CONTROL STORE POWER 9.1.3
SET TARGETING & SEPARATION PARAMETERS 9.1.4
SELECT/ENTER STORE PROGRAMS 9.1.5
PERFORM STORE INITIALIZATION ROUTINES 9.1.6
TEST ARMAMENT SYSTEM/STORES 9.2
SET TEST PARAMETERS 9.2.1
CONTROL TEST MODES 9.2.2
CONDUCT BUILT-IN-TEST 9.2.3
CONDUCT FAULT ISOLATION 9.2.4
TRANSMIT STATUS DATA TO BASE 9.2.5
CONTROL ARMAMENT SYSTEM/STORES 9.3
CONTROL SAFETY INTERLOCKS 9.3.1
SELECT OPERATING MODES 9.3.2
SELECT STORES 9.3.3
SLAVE STORES TO AVIONICS DATA 9.3.4
TRANSMIT STORES DATA TO AVIONICS 9.3.5
ENABLE RELEASE FIRE CIRCUITS 9.3.6
CONDUCT RELEASE/FIRE 9.3.7
DETECT SEPARATION 9.3.8
UPDATE INVENTORY 9.3.9
CONDUCT POST-SEPARATION CONTROL 9.3.10
JETTISON STORES 9.4
SELECT JETTISON CONDITIONS 9.4.1
CONTROL SAFETY INTERLOCKS 9.4.2
ENABLE JETTISON 9.4.3
CONDUCT JETTISON 9.4.4
DETECT JETTISON 9.4.5
UPDATE INVENTORY 9.4.6

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NAVAIRDEVCENT DESIGN TEAM (CDT)

The Naval Air Development Center Design Team was established by the Center Management Group in February 1977. Membership on the Center Design Team (CDT) is by appointment from the Center's Technical Departments, usually for a period of 12 - 16 months in order to foster rotation of personnel. The following is a listing of the present CDT members (and their particular area of expertise) who were responsible for the formulation of the V/STOL 'A' - Avionics Funtional Description - II.

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Chapter 2 REQUIREMENTS ANALYSIS	
	*Irwin Rabinowitz (Software)
Chapter 3 NOTIONAL SYSTEM CONCEPTS	
	*Steve Ganop (Navigation)
Chapter 4 ISSUES	
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